AVIATION AND AIRCRAFT JOURNAL

FEBRUARY 7, 1921 VOL. X. NO. 6

Member of the Audit Bureau of Circulations

INDEX TO CONTENTS

Editorials	163	Plant of the Aeromarine Plane and Motor Co.	171
Brig.-Gen. Mitchell's Startling Testimony	164	U. S. Imports and Exports of Aircraft	176
Economy and Aerial Defense	168	Italian Aviation	177
The Big Ship Controversy	168	What a Pilot Has to Watch	177
The Navy Building Program	168	N. A. C. A. Praises Air Mail	178
The Zeppelin Staaken Airplane	169	Airplane Radio Direction Finding	179
The Z.R.-2 May Cross Atlantic in May	170	A German Rival to the Handley Page Wing	179

THE GARDNER, MOFFAT COMPANY, Inc., *Publishers*

HIGHLAND, N. Y.

225 FOURTH AVENUE, NEW YORK

SUBSCRIPTION PRICE: FOUR DOLLARS PER YEAR. SINGLE COPIES FIFTEEN CENTS. CANADA, FIVE DOLLARS. FOREIGN, SIX DOLLARS A YEAR.

COPYRIGHT 1921, BY THE GARDNER, MOFFAT COMPANY, INC.
ISSUED EVERY MONDAY. FORMS CLOSE TEN DAYS PREVIOUSLY. ENTERED AS SECOND-CLASS MATTER NOV. 22, 1920, AT THE POST OFFICE AT HIGHLAND, N. Y., UNDER ACT OF MARCH 3, 1897.

Wittemann-Lewis Aircraft Company, Inc.

Builders of Aircraft since 1906

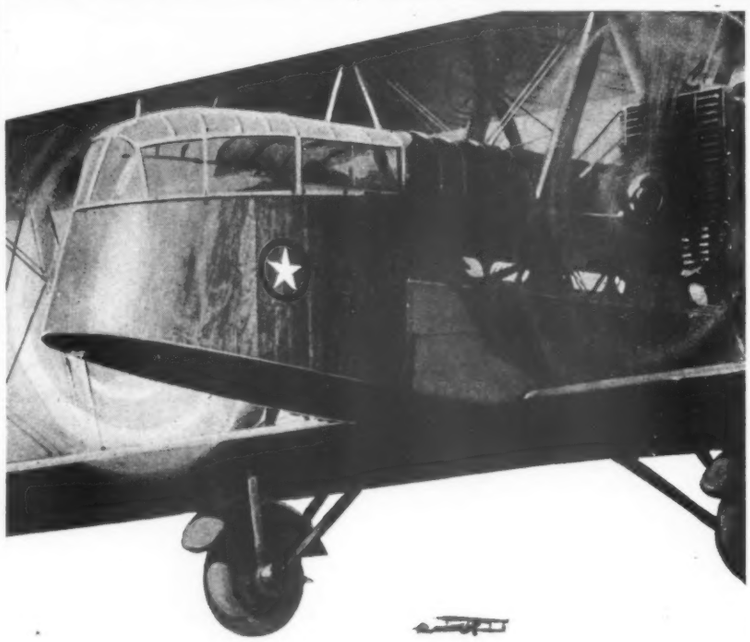
CONTRACTORS TO THE U. S. ARMY, NAVY AND AIR MAIL SERVICE

Plant and New York Air Terminal

TETERBORO, HASBROUCK HEIGHTS, NEW JERSEY

"Six Miles from the Heart of New York"

TRADE MARK



TRADE MARK

SPEED

INDUSTRY TODAY demands quicker distribution --THE SPEED OF THE AIRPLANE.

The distance from New York to Washington by rail is 228 miles--the airline is 200 miles. Express trains require 6 hours for the trip; the airplane--2 hours.

The New York-Cleveland route, by rail, is 620 miles --by airline, 425 miles. The fastest train-time is 13 hours; the airplane makes it in 4 1/2 hours.

The Cleveland-Chicago route, by rail, is 357 miles--time 7 hours; by air 315 miles--time 3 1/2 hours.

Geographical location is no longer a commercial handicap. The inaccessible mine and the remote oil field are now linked with the markets of civilization.

If *Speed* in transportation is of importance to you--discuss your problem with us.

THE GLENN L. MARTIN CO.

CLEVELAND

Member of the Manufacturers Aircraft Association

TRADE MARK

TRADE MARK

1921

ENOCH PRATT FREE LIBRARY BALTO.

AVIATION
AND
AIRCRAFT JOURNAL

Vol. X FEBRUARY 7, 1921 No. 6

Aircraft vs. Capital Ships

THE following remarkable discussion of aircraft versus battleship was sent to AVIATION AND AIRCRAFT JOURNAL by C. G. Grey, the distinguished editor of *The Aeroplane*. It was written on January 14, before General Mitchell's statement on the same subject was made in Washington.

I am glad to see that you are interested in the subject of Aircraft versus Capital Ships. Briefly, my personal opinion is that the capital ship of the future will be a very big high-speed aircraft-carrier which will use torpedo airplanes instead of long range guns and otherwise will be equipped with what is now considered secondary armament for use against hostile airplanes and against submarines. She will also have to carry fighting airplanes to repel torpedo droppers.

Bomb dropping against ships is harmless as compared with torpedo dropping. Think of the number of errors which a bomb dropper can make. A torpedo dropper, on the other hand, has not to worry about anything except line. The torpedo itself looks after its altitude in relation to the surface of the water. The speed of the airplane hardly matters in the least, so the only thing the pilot has to think about is the speed of the vessel which he is going to torpedo and the distance she will cover in the time his torpedo will take to reach her. And, as he probably has 300 feet of ship for target, he has a pretty wide margin for error. Big guns on ships are now practically useless because their range is limited not by the gun but by the human eye, by the curve of the earth (i. e., the horizon), and by the atmospheric visibility prevailing at the moment.

Apart from that, the naval gunner in any fleet is about the worst gunner in the world. I think it is pretty generally admitted that the shooting of the U. S. Navy was not as good as ours, and ours was certainly not anything like as good as the Germans. If the Germans had had a fleet 60 or 75 per cent. as big as ours at Jutland they would simply have blown us out of the water on sheer superior gunnery.

Even so, British naval gunnery is not bad as naval gunnery goes, but compared with the army artilleryman's gunnery it simply does not exist. The naval gunner practically knows nothing of the elements of really scientific artillery work as understood by the field artillery or the garrison gunner. Still less does he know anything about the completely new science of aerial gunnery as developed by our anti-aircraft gunners in the London Air Defence Area during the war. Consequently the sooner the Navy's guns are taken away from it and replaced by airplanes flown by people who do know something about their job the better for the navy.

What is really at the bottom of the bad naval gunnery is the fact that the naval gunner shoots purely on sight at a target on his own level and consequently corrects by results. The army artilleryman has to shoot at targets anywhere above him or below him and as often as not has to fire by the map without seeing what he is firing at at all. That is why the army is more scientific.

Finally, apropos naval aviation, did you see the statement that in an attack by, I think it was eight, airplanes carrying torpedoes on the British fleet anchored in Portland Roads the airplanes scored six direct hits, each of which would certainly have sunk its ship and at any rate would have put it completely out of action. The airplanes came over from Gosport near Portsmouth, preceeded by two bombers which flew at about ten thousand feet where, of course, the flat-footed sailor man neither heard nor saw them. Instead of dropping bombs the bombers dropped a string of smoke-bombs about a mile to windward of the fleet. Before the smoke cleared away and before the fleet had a chance to use a gun, the torpedo machines came through the smoke down wind at about 130 miles an hour, so low down and so fast that no earthly naval gun would have had a chance of hitting any of them. It is practically certain that given an adequate force of torpedo aircraft no hostile fleet could get within 100 miles of any coast so defended.

Aircraft Union Stations

THE establishment of a flying field in Los Angeles for use of all aircraft companies operating airplanes in the vicinity is the beginning of a logical development that will spread to all cities as commercial aviation develops. Probably the greatest stumbling block in the way of aviation progress is the lack of ground organization in all its branches. If a company is required to buy and equip every flying field that it needs to run an airway the proposition becomes too big for any ordinary organization to handle. In addition, after that company is in operation, a second company may wish to serve some of the same cities. This second company would be forced to either pay a high rent to a competitor or establish another field of its own. Providing two fields where one would serve is an economic waste.

Flying fields should logically be established and maintained by the state or municipality in the same manner that land and water highways are now maintained, without prejudicing private construction. This has been the policy of the Air Mail as far as possible. Many municipal fields have been established to attract the mail. The reason for public flying fields lies in the fact that it is of paramount interest to the state that flying fields be established all over the country for reasons of national defence and commercial advancement.

The provision of proper and uniform national regulations governing the operation of aircraft is also essential. Flying fields are imperatively needed but their value would be somewhat vitiated by a lack of traffic regulations and by bickering among the users of the fields as to their respective rights due to a lack of proper control.

Air Tournaments

CALIFORNIA has pointed the way to the successful method of conducting an air tournament. When thirteen thousand people will go to a field and witness a tournament and one hundred thousand go to the vicinity to see a free show, it is clear evidence that air meets have an attractive value that a community desiring such publicity must recognize.

The exhibition feature of such tournaments, where the public may become acquainted with various types of aircraft is helpful to the Army and Navy and deserves their encouragement.

If sufficient local support can be secured it is planned to have several such tournaments in other parts of the country this year.

Brig.-Gen. Mitchell's Startling Testimony

Claims Aircraft Can Render Big Naval Battleships Obsolete

The following testimony of Brig.-Gen. William Mitchell before the House Appropriations Committee has caused national discussion of the controversy over the future of the $45,000,000 battleship. Secretary Daniels has commented on the statements made. If General Mitchell is right on this national defense problem the sooner the country knows it, the better.

MR. ANTHONY. General Mitchell, you are looked on as one of the active flying men of the flying service, a man of fighting experience, and we would like, in a general way, to have your ideas of the necessities of that branch of the service.

GENERAL MITCHELL. Mr. Chairman, I would like to explain first what I think should be the general idea underlying the development of the Air Service in this country. In order to apportion the money for national defense properly, we should make an accurate estimate of all of the capabilities of each branch of the service, that is, what the Army can do, what the Navy can do, and what the Air Service can do. If we do not make an accurate estimate and a possible enemy does make one, we will be under a great disadvantage in case of a great emergency. During the war, the Air Service was developed essentially for fighting over the land, as the Allies held the sea to a greater extent than any great combination ever has before. To begin with, aviation was used entirely for observation purposes; that is, for reconnoissance, for the adjustment and regulation of artillery fire, and for keeping contact with the troops so as to report their position. At the end of the campaign, the aviation was 80 per cent offensive and only about 20 per cent observaton. The moment that airplane attacked airplane, the principal mission of the air force was to whip the hostile air force, so as to enable the airplanes to observe, to drop bombs, or attack troops. So that, today, the principal mission of an air force is to destroy the hostile air service, just as the mission of an army is to destroy a hostile army.

Offensive aviation has developed along three lines. Pursuit aviation was the first offensive aviation developed as a separate branch, that is, the aviation which pursues hostile aircraft and shoots them out of the air. Pursuit aviation, at the end of the campaign in Europe, constituted more than 60 per cent of all offensive aviation.

The next branch of aviation which was developed was that whish carried missiles and dropped them—bombardment aviation, it is called. This started with bombs weighing 25 pounds; at the close of hostilities, some were using bombs weighing up to a ton. Today, we can carry more. In connection with bombardment, this war has demonstrated the efficiency of high explosives as distinguished from fragmentation. We can explode high explosives on the outside of an object and obtain very great results from that alone. As an example of that, I might cite the explosion at Halifax. The results of experience show that air projectiles are the most efficient from the standpoint of explosives of any we ever have had. A one-ton cannon projectile has only 55 pounds of explosive in it. The air projectile weighing that same amount will have from 1000 to 1400 pounds of high explosive in it. This is because it is not necessary to give it great weight to have it go straight and insure a good trajectory. Bombardment aviation can use gas projectiles also.

The third branch of aviation developed was for the attack of the armies on the ground, and which we call attack aviation. This branch uses airplanes equipped with a number of machine guns, and we now have ships which carry both machine guns and a cannon, and are armored to cover the personnel and engines. We shot a 2.95 howitzer from an airplane the other day. That is practically a three- inch gun, and I am convinced that we can fire a six-inch gun from the air. That 2.95 howitzer was fired from a Martin bomber.

So we have developed three different branches of aviation—the pursuit aviation, attack aviation, and bombardment aviation—and, in our country, the proportion should be about sixty per cent pursuit, twenty per cent bombardment, and twenty per cent attack. In addition, there is the observation aviation which is attached directly to ground or air troops.

To begin with, let us consider the use of an airplane over land. In the first place, in order to insure protection of observation aviation, of the force you are working with, you have to keep the enemy out of the air to a sufficient extent to let the observation aviation work. That means that you must have an efficient force of pursuit aviation. If you are going to attack hostile bombardment airplanes, you must have pursuit aviation; if you are going to keep attack aviation in advance of the infantry, you must have a strong force of pursuit aviation.

MR ANTHONY. To put them down?

GENERAL MITCHELL. Yes, sir. Pursuit aviation is the basis of an air force, just as infantry is the base on which an army rests.

MR. ANTHONY. That is what we have been weak in?

GENERAL MITCHELL. Yes, sir; we have not had any in this country. We now have a pursuit ship that is as good as any ship of its type in the world.

MR. ANTHONY. That is the Thomas-Morse pursuit ship?

GENERAL MITCHELL. Yes, sir. There is no defense against an air force except an air force. No weapons operating from the ground can greatly affect aviation. We lost about one-tenth of one per cent of our ships in Europe from anti-aircraft fire from the ground. It took from four to five thousand rounds from anti-aircraft cannon to hit one ship. The only way you can get protection is to have the pursuit aviation and searchlight and missile throwing weapons working together. There has been some development in Europe in the attack on airplanes. We are still going along in very much the same way. Conditions, however, are very hard, so far as hitting ships in the air is concerned.

We will attack the anti-aircraft gun on the ground and very largely nullify it. Of course, we will have to stand our losses, like everybody else. To hit anything in the air, you have got to see it. Actually, the only defense against an air force is another air force, and only enough money should be put into anti-aircraft artillery which the air units themselves require to work with them. The air is a very big place; it is a three dimension proposition, so an airplane often is able to go through the air or over the clouds so that the people on the ground can not see it.

The other fellow can get to you in a much easier way in the air than on the ground. The problem between two armies is not so much a question of whipping the troops on the front line, but it is a question of destroying the reserves. If, for any reason, you could gain control of the air to a sufficient extent to allow you to surprise the enemy, and the enemy did not know anything about it, as the Germans did in their March, 1918, attacks on the western front, when they practically surprised the Fifth British Army, because they made their principal movements at night, you have a tremendous advantage. But, if you have an air force comparatively equal to that of the enemy, as was the case on the western front, you cannot give him any surprise, at least not very much of a surprise, because both air forces neutralize each other. At Chateau-Thierry, because the allied observation aviation worked at night, the German attack was not a surprise at all.

We were beginning to get ascendency in the air at the end of the war. You can see from our ratio of victories that our percentage of air losses was constantly falling in proportion to the number of the enemy that we shot down, showing that we were gradually gaining control. This was only after a series of tremendous air battles. The Germans were so heavily attacked in the air that they were put on the defensive and could not keep up their supply of men and material. The men are the all important things. It is very necessary to keep up your supply of skilled pilots in connection with aeronautical operations. You can usually keep ahead on your material after you get to a certain point of development in your production. It takes years to develop a really efficient aviation personnel.

Reserves can be attacked from the air in two ways. You can hit them with attack aviation when they come up on the roads, the infantry and the artillery in column moving up toward the front lines; also their motor and railway trains. Aviation can also interrupt communication at the various centers where many roads and railways meet. We believe that, in the next war, gas might be used by a barbarous foe on the centers of communication. We know just how much gas has to be put down on those centers to interrupt communication. For instance, take New York, and consider an area in the vicinity of New York ten miles by ten miles, or or an area of 100 square miles. If two tons of crying gas are dropped by airplanes or airships there once in eight days, it will make everybody wear gas masks and goggles. If we want to keep that place covered with mustard gas, we can put down 70 tons once in eight days, and everybody will have to protect themselves against mustard gas in that area. If we want to kill everybody in that area and use phosgene, we have to put 200 tons of phosgene once in eight days, and it will keep that area covered. All you have to do is to go over that area once every eight days and keep it inundated with gas. The only protection against such a procedure is protection in the air. As to the columns moving up, they will all move at night and our attack aviation is designed to attack those columns. Attack airplanes are armored; they have three-eigths inch armor all over their vulnerable parts. They carry a 37 mm. cannon and eight machine guns. They are almost developed. We have one type of these ships which we can put into production now. We are still developing them. So much

RANGE, EFFICIENCY AND EXPENSE OF AERIAL BOMBING COMPARED WITH R. R. ARTILLERY. DISTANCE IS SHOWN THAT PLANE WILL TRAVEL WHILE ARTILLERY IS PREPARING GUN FOR FIRING. ONE MARK VI BOMB IS MORE EXPLOSIVE THAN SEVEN 14-IN. H. E. SHELLS

Percentage of Hits, 14.29

14-IN. R. R. GUN

Initial Cost	$400,000
Life (No. of Projectiles)	150
Depreciation per Shot	$2500
Direction of Action	Dependent on Track and Terrain
Weight of Projectiles	1660 lb.
Range from Position	12 to 20 miles
Target for	Land and Air Attacks
Personnel Required	125 Men, 1 Officer

Percentage of Hits, 19.53

BOMBING PLANE

Initial Cost	$40,000
Life (No. of Bombs)	Not Dependant on No. of Bombs Carried
Depreciation per Bomb Dropped	Not Relative to No. of Bombs Dropped
Weight of Bomb	1100 lb.
Weight of Explosive	600 lb.
Range of Action from Base	300 Miles
Target for	Air Attack
Personnel Required	9 Men, 2 Officers

for the use of airplanes over the land or in conjunction with an army.

Next, we may consider their use over the water. An army fights on land, a navy on the water, but an air force over both. To begin with, we can tell you definitely now that we can either destroy or sink any ship in existence today.

MR. ANTHONY. You think the experiments in connection with the *Indiana* were successful?

GENERAL MITCHELL. Yes, sir, absolutely. All we want to do is to have you gentlemen watch us attack a battleship.

MR. ANTHONY. Does the Navy regard those tests as conclusive?

GENERAL MITCHELL. All the flying officers do..

MR. ANTHONY. Do the Navy line officers consider those tests conclusive?

GENERAL MITCHELL. I can not answer for them. Their whole training is that the armored ship is the mistress of the sea, whereas, actually, it is just as helpless as the armored knight was when the fireman was brought against him.

MR. CRAMTON. Do you mean, General, that experiments as vital as those on a subject as vital as that of national defense are not being studied?

GENERAL MITCHELL. The air is less known today than any other branch of the national defense, and it is less known in this country than in any country in Europe. All we want is a chance to demonstrate these things and have you gentlemen see them.

MR. ANTHONY. In connection with the result shown on this photograph you have produced before us, how much explosive did it take to accomplish that result?

GENERAL MITCHELL. There were nine hundred pounds of explosive there, of which 880 pounds were TNT and 20 pounds were amitol. It is the ordinary bomb of that capacity developed several years ago. It was just laid there on the deck. If that had been dropped from an airplane, it would have blown the ship into fragments.

Only dummy bombs were dropped to see what hits could be made. I have here a statement of the total number of bombs tried out on the *Indiana* by the naval air service. That work was done by a personnel with very crude equipment and little experience in dropping them, but they did very well. This is the size of the *Indiana;* this is the size of a modern ship, about 814 feet long, and this is the danger area around the ship, in connection with the bombs. All of them, except about twenty-two, would have been in the danger area of the modern ship.

We have a complete project, involving the use of smoke, the use of gas and attack aviation, to neutralize the anti-aircraft attack and to destroy the ship. There are two things about attacking shipping. There is no trouble about destroying any unarmored ship. There was one small bomb which was exploded in the water some distance away from the torpedo boat destroyer *Smith*. The destroyer began to sink and was towed away. All unarmored vessels can be sunk without any trouble at all. The *Indiana* was made to begin to sink by one bomb with only 214 pounds of explosive, placed about 60 feet below the water and 50 feet away from her stern. It damaged the stern of the ship, bent the rudder post and propeller shaft. They towed her ashore and let her sink. The thickest deck we have to pierce is about three inches thick, and the maximum amount of any ship we know of is about seven, which is that of the *Hood* class in Great Britain. There is a 3-inch ballistic deck about four decks down. If you hit that in any way, we are convinced it will put a ship out of action, not only from the shock, but from the fumes, the gas, and the general concussion. We are ready to demonstrate that at any time.

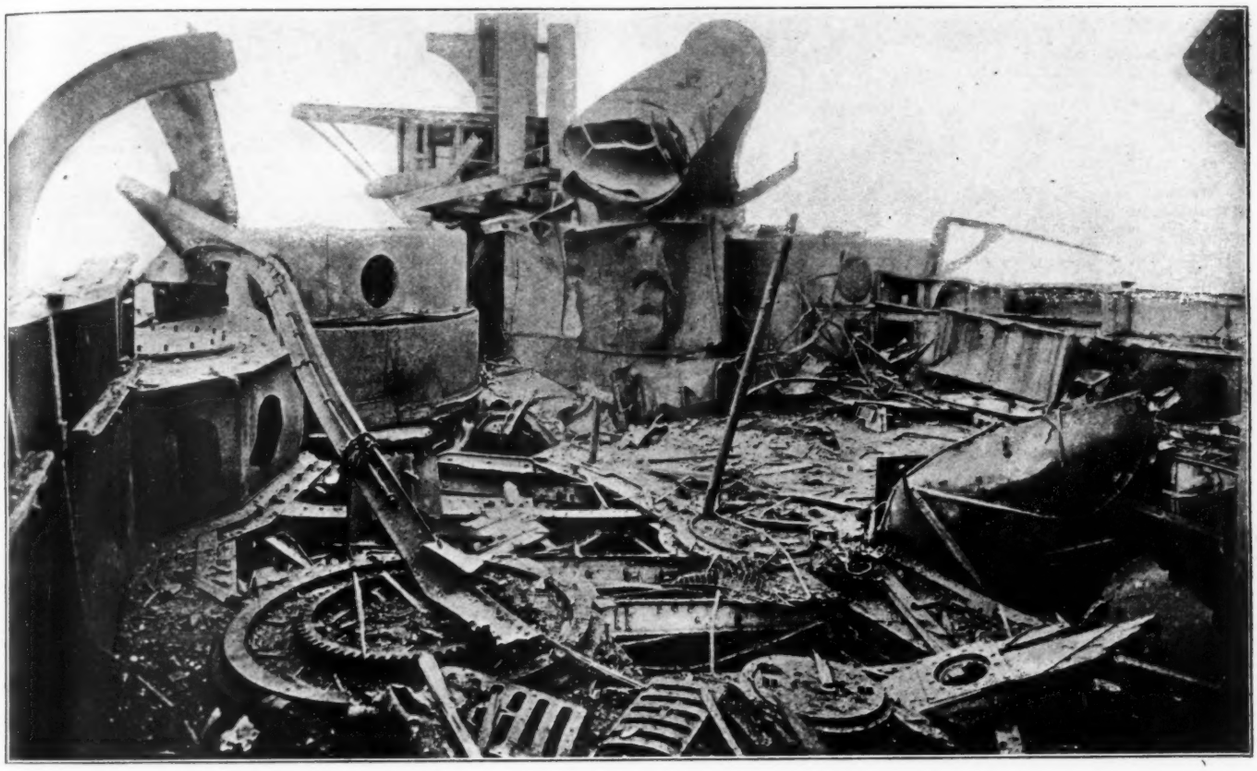
MR. ANTHONY. What is the situation in regard to the accuracy with which you can drop one of those bombs?

GENERAL MITCHELL. We can hit very often, if we have to, because, if necessary, we will come down and lay the bomb on the deck. Here is a comparison between the accuracy of aerial bombing and cannon fire (indicating on chart). Over 18,000 yards, we believe the percentage of hits, even with modern methods of fire adjustment, from the shore will be very small. We do not believe that, at 40,000 yards, you will make over one per cent of hits with cannon, and we believe that, with the same number of airplanes required to adjust the fire, we can make at least 40 per cent of hits. As a large cannon has an accurate life of only 200 rounds, you will therefore get about two or three hits with it against a ship at 40,000 yards.

Distance is nothing to airplanes. Our accuracy is the same up to the limit of our gas capacity. Our ship has about a five and one-half hour supply of gas and she can work 200 miles off the coast. It is just as accurate at 200 miles as it is near the shore. All other countries have taken that into very serious consideration.

The French are keeping their air force in service—a force of 3000 ships being kept up. The French Air Division, which has approximately 1600 ships is in Alsace Lorraine now, and it is planned to be used as their offensive force in case any trouble starts. It is their first line of defense. The British have an air force in their own country and also in the colonies, and that is being developed largely to fight over water. It also is their first line of defense. They do that by putting their aircraft on aircraft carriers and having them go out and fly over the water. They can take any of their airplanes and put them on aircraft carriers and go out and fight, and then, in addition to that, they can attack hostile water vessels at any distance up to the limit of their fuel capacity.

The air force is an independent branch coequal with the army and navy. I have projects here for aircraft carriers with ships that exist today. I would take the *Von Steuben*, the *Agamemnon*, and the *Leviathan*, and transform those three ships into aircraft carriers, including oil burner installations, for $12,000,000. We can put on this vessel one pursuit group of 100 airplanes, and we can put on the *Imperator* one squadron of bombard-



EFFECT OF AN AERIAL BOMB DETONATED ON THE DECK OF A BATTLESHIP

It will be noticed that the turret is cracked and demolished; the whole deck is swept clean, and several decks down below smashed up and damaged; the deck above blown off, and the damage extended to practically all parts of the ship.

A direct hit by an aerial bomb on a battleship will break every electric light globe on the ship, throw her into absolute darkness below-decks; will disrupt telephone, radio, and interior communication systems; fill fire rooms, engine rooms and all compartments ventilated by force draft, with noxious gases; cause shell shock to the personnel practically all over the ship; will disrupt ammunition hoists, dislodge and jam turrets, dish upper decks, kill all personnel on upper decks, anti-aircraft gun crews, fire-control parties in the tops, or anyone standing on deck; will cause fire to break out, exploding all anti-aircraft ammunition on upper decks, and sink or disable the battleship. If exploded in the water alongside, it will either sink or permanently disable it.

ment planes, and we can put on the other ship two squadrons of attack planes. If we had those, I do not think any navy could do much business now against us. We could attack opposing shipping wherever we wished, and gain the ascendency. These vessels have the same speed as the fastest battleship,—about 23 knots. We should build new carriers with 40 knots an hour. Those changes can be made rapidly, and it would give us a fighting force such as no other country, except England, has. There is no reason why it should not have been done long ago. Personally, I think it is foolish to send any navy out against England today with the air force which she has. I can not see any result from it except destruction. She can concentrate her whole air force wherever desired, over land or water. It is a single force and not split up.

MR. SLEMP. Why is it, if your statements are true—and I am not casting any doubt upon them at all—that you are not able to convince the high ranking officers of the Army who have the consideration of these problems? For example, General March told us that, if some foreign power defeated our Navy, they could land any number of troops on our shores that they pleased, without reference at all to any air force we might have or any activity that our air force might be engaged in. If these statements of yours are true, why is it that these officers cannot see the light? What is your explanation of that?

GENERAL MITCHELL. We are presenting the situation to you, and we are ready to demonstrate this thing. If you allow no air force, not only will an opposing fleet land at will, but their aircraft will fly all over our country.

MR. SLEMP. Why cannot the higher officers of the Army see it?

GENERAL MITCHELL. You are to judge which is the best evidence. We are ready to demonstrate every statement we make.

MR. SLEMP. What does that mean? They are intelligent individuals, and they want to get the best defense they can for the country.

MR. CRAMTON. Is it not for the same reason that confronted Ericsson, in that after he had demonstrated the success of the *Monitor* still he could not get the ear of the high ranking officers of the War Department.

GENERAL MITCHELL. We can show right straight through from the begining how the thing has been held down, first in Prof. Langley's time and then in the Wrights' time, but today it is not quite as bad as it was, although it is almost as bad.

MR. ANTHONY. It was not held down during the war.

GENERAL MITCHELL. We had nothing to do about that. So far as the mere amount of money put into the thing is concerned, you are putting in now over $100,000,000 during this last year. The list of money being expended for the Air Service in this country is roughly as follows. This does not include many items of maintenance, expenses of sick and retired lists, or things of that kind. The items are approximately as follows:

(a)	Under Army appropriations we find the following:		
	AIR SERVICE:		
	Maintenance and operation		$33,000,000
	This appropriation is to be expended as follows:		
	Experimental and research work	$5,250,000	
	Production and purchase of new airplanes and equipment	6,000,000	
	Claims	150,000	
	For establishment of buildings and improvements at stations	245,000	
	For purchase of Selfridge Field	190,000	
	Military surveys and maps	100,000	
	Bureau of Steam Engineering radio shore stations		$ 20,000
	Increase for aviation Signal Corps, 1918 (Closing up old contracts and claims.)		$24,465,187
	For pay allowances, etc. of the Army Air Service		$25,360,000
	Estimated on 1540 officers @ $4,000—$6,160,000		
	16,000 enlisted men @ $1,200—19,200,000		
	Portionate part of appropriation for the subsistence of the Army based on 16,000 enlisted men in relation to 280,000. The proportionate part of $32,000,000		$ 1,830,000
(b)	NAVAL AVIATION:		
	Procurement, production, operation and maintenance		$20,000,000
	This appropriation to be expended as follows:		
	Necessary aircraft	$3,883,400	
	Necessary equipment	300,000	
	To continue construction of 1 airship (authorized)	1,500,000	
	New construction at stations	4,962,000	
	New equipment for training	100,000	
	Maintenance of plants and overhauling	6,044,000	
	Experiments and development	2,935,000	
	Pay of classified force	275,000	
	Aberdeen Proving Ground For construction of 1 Steel hangar to accommodate 1 U. S. Navy C-2 airship.	150,000	
	Expenses of Investigating Committee on establishment of aviation bases at Sand Point, Washington and Port Angeles	50,000	
	Pay of Navy personnel		$ 8,000,000
	Estimated on 500 officers @ $4,000—$2,000,000		
	Estimated on 5000 enlisted men @ $1,200— 6,000,000		
(c)	POST OFFICE:		
	To purchase airplanes and maintain aerial mail service		$1,250,000
	Alaska mail route (Subject to disposal of Postmaster General)		255,000
	To establish new aerial mail routes at discretion of Postmaster General		1,250,000
(d)	FORTIFICATION FOR SEACOAST DEFENSES:		
	Installation of searchlights and replacements including those for anti-aircraft defenses		566,250
	Air Service station, Hawaii		1,300,000
	Air Service station, Panama		239,100
	Air Service station, insular possessions		302,046
(e)	FOREST PATROL:		
	Fighting and preventing forest fires		
	Maintenance of air patrol		
(f)	MISCELLANEOUS:		
	National Advisory Committee for Aeronautics		$ 200,000
	Bureau of Standards, for investigation of standardization of methods and instruments employed in radio communication		30,000
	To develop methods of testing and standardizing motors, tools and instruments in response to the requirements of aeronautics		15,000
	Officers to take aeronautical engineering at colleges and universities and for text books necessary therefor		Unexpended Funds.
	Government Printing Office		$ 50,000
	War Department	$ 25,000	
	Navy Department	$ 25,000	
(g)	GENERAL ARMY APPROPRIATION:		
	Proportionate part of all appropriations for regular supplies of $28,000,000 based on 16,000 enlisted men as compared with 280,000 for the whole army		$ 1,600,000
	Incidental expenses based on same proportion		357,000
	For develoment, manufacture and purchase of airplane bombs and		$ 1,000,000
	For development, test, manufacture and purchase of sighting devices for bombs		
	For small arms target practice		$ 28,600
	TOTAL		$121,168,183

MR. SLEMP. You have not a single practical illustration of the success in battle of the experimnts which you think could be put effectively into use.

GENERAL MITCHELL. Yes, sir, we have. Take the battle of the second day at Montfaucon in our attack in the Argonne. Three divisions were put through a little place called Arcourt, and a congestion of transportation took place there which did not move on the first day for about seventeen hours, and on the next day for about thirteen hours. The Germans immediately saw it, and started their air attack on us. We saw it as quickly as they did, and we attacked all their airdromes with bombardment aviation. We put all our pursuit ships over their lines. The result was that their attack aviation was not protected by their pursuit aviation, and our pursuit aviation was left free to attack their attack aviation. We did not lose any motor transport at all, and we shot down during the month about four times as many ships as they did.

MR. CRAMPTON. May I ask you this question? Is it not a fact that in England today the great issue, which has become a great popular issue, that is attracting great attention throughout the island, is the question of the reversal of their naval policy by reason of the possibility of attack from the air?

GENERAL MITCHELL. Yes, sir.

MR. CRAMTON. And a great section of those naval experts are insisting that the advantage of the capital ship is largely in the past by reason of the possibility of attack from the air?

GENERAL MITCHELL. Yes, sir. We should demonstrate the matter conclusively as we go ahead, but we ought also to try to avoid mistakes by not getting too far behind. Eventually, you will find that, dollar for dollar spent, you will get more from an air force than from submarines, as an air force will both protect sea communications and destroy hostile vessels.

MR. SISSON. I presume the English have about the very best talent they have both in the army and navy taking into consideration the situation in reference to all of continental Europe, and if England has adopted the policy you have just indicated it means that she has got enough experience out of this war or out of certain experiments or scientific studies in the development of air effectiveness to warrant her in the carrying out of the policy she now adopts of absolutely controlling the air, as she has heretofore tried—and successfully—of controlling the sea.

GENERAL MITCHELL. Yes, sir, that is absolutely the case. The English air force has made several attacks in maneuvers against fleets in which the air force has theoretically sunk the naval vessels.

MR. SISSON. If England has adopted that as the best policy, taking into consideration all the great dangers of attack which she has on account of proximity to what might possibly become enemy nations, it would simply accentuate the idea that the United States might make some investigation of the effectiveness of its defense through its air service, and if not to do more than imitate, at least not to get too far behind in the development of that service.

GENERAL MITCHELL. Yes, sir. We can easily lead at a comparatively small cost. We have the men, material, and factories all within our own country. No other nation is so well placed.

MR. ANTHONY. If the theory you advocate is correct, does it not mean that the whole present system of coast defense will be made obsolete?

GENERAL MITCHELL. Yes, sir. Our system of coast defense today is wrong. The only way to really defend a coast is with aircraft and mobile troops and their accessories.

MR. ANTHONY. You virtually propose to wipe out the fixed coast defenses?

GENERAL MITCHELL. Not entirely. I think we ought to have some. We ought to keep a certain number of fixed guns around the naval ports and the air ports, but a wholesale emplacement of heavy artillery all over our coasts is a useless waste of money and may create the impression of security when, actually, it is a point of weakness.

I believe the largest railway artillery guns would cost about $500,000. Their ammunition costs about $1800, with the powder charge for the armor-piercing projectile. We can build ten bombardment airplanes with that amount of money, and our one-ton ammunition, carrying twenty times as much explosive, will cost about $900. That coast defense gun is limited to a life of 200 rounds, and the only limit of the airplane is the life of the motor. Those guns will make probably not over one per cent of hits at 40,000 yards, while the airplane percentage of hits is the same at any distance. The vulnerable part of our country is from the Chesapeake Bay up to Boston, and from New York to Chicago. By having an air force ready for action somewhere in New Jersey, you can reach any part of that area within two or three hours, whereas you could not do it in less than a day or two with those guns, and then they could have little effect. You must remember that it takes an hour at least to put those guns into firing position, and we can go 110 miles an hour with our bombardment airplanes—much more with our pursuit. We can shift our air force within twenty-five to thirty flying hours from the east to the west coast, and from the north to the south in the same proportion of time. Our airplanes have gone from New York to Nome, Alaska, in fifty-six hours flying time. You must remember also that these battleships cost $45,000,000, and we can build a thousand airplanes for the cost of each battleship. All we want in connection with this matter is to have you put the money where it will do the greatest good. We do not ask you for more money than we had last year. I think the figures will show that you are spending over $100,000,000 on aviation this year.

MR. ANTHONY. You mean the combined appropriations?

GENERAL MITCHELL. Yes, sir. We are losing at least thirty per cent efficiency on account of the way it is being spent, and it is not being developed along the line I spoke of except by our Air Service.

With an air force base on Puerto Rico, we can defend the Panama Canal from navies by watching the sea interval of 60 miles between Cuba and Haiti, of 100 or so between that island and Puerto Rico, and of 360 miles between Puerto Rico and South America. That is the true defense of Panama from the east.

MR. ANTHONY. This is all new, in addition to the estimate?

GENERAL MITCHELL. We will supply the force from the amount you are giving us according to the general ideas I have mentioned. We are asking you for $17,000,000 for the construction of airplanes for the units we now have in service—just as the infantry asks for rifles to arm their men.

MR. ANTHONY. Your argument really leads up to the advocacy of a combined air service.

GENERAL MITCHELL. There is no other efficient solution of the air problem, if you are going to get on a basis of efficiency. If you scatter the air force all around, it leads to double overhead, to a double system of command, and to many other difficulties. It has been proved wrong everywhere. We had ships flying over the vessel on which Senator Harding returned from Panama the other day, and the Navy had some airships there and we were getting in one another's way. It would be fatal in war, as it was in Europe at first.

MR. ANTHONY. And they were all under separate commands?

GENERAL MITCHELL. Yes. The British at first had the same thing, but they learned better when the German raids were on during the war. The German Gothas flew over London without any particular difficulty just for that reason. The Army Air Service worked over the land and the Navy over the water. Neither did anything; the German Gothas were slow ships,, but there was no defense whatever against them. Finally, when they got a united air service and the air defense organized, it stopped the airplane and Zeppelin raids.

MR. CRAMTON. Have any of the other nations adopted a unified air service?

GENERAL MITCHELL. Yes, sir; England has an entirely unified air service. France has a bureau of civil aviation, and still has an army and a navy air service, but their navy air service amounts to almost nothing. Italy has her army air service run everything. It makes details for work with the navy, as I understand it.

MR. CRAMTON. France is going to considerable lengths to encourage the development of commercial aviation, is she not?

GENERAL MITCHELL. Yes, sir. I would like to say a word about a commercial air service. An airship service between New York and Chicago, on the basis of three and one-half cents a mile for passengers, with a capitalization of about $25,000,000, allowing for fifty per cent depreciation of your equipment every year, will, I believe, pay one hundred per cent after three years.

MR. CRAMTON. To what extent is commercial development of that kind beneficial to our national defense?

GENERAL MITCHELL. Every pilot, every ship, and every airdrome are distinct assets as a part of the national defense. What the Post Office Department is doing is a most efficient adjunct to the national defense. We could not have gotten an airway across the country unless that had been done. Airways are essential to the operations of military and commercial aviation.

MR. CRAMTON. I have recently read that Germany despite the treaty restrictions was going to proceed, within the limit of the restrictions, to get ready to further the development of commercial lines, as far as the treaty permits. This morning I clipped an item with reference to the French plans in which I note that France is devoting subsidies to ventures of the kind you refer to.

GENERAL MITCHELL. Germany sees in the air her means of controlling the sea in the future, and her principal weapon of offense.

MR. CRAMTON. There has recently been held in Germany a meeting or a reunion of those men who served in the air service during the war, and every step possible is being taken for development along that line.

GENERAL MITCHELL. That is true, and most important from the German's standpoint.

MR. SLEMP. It seems to me the principal problem is to demonstrate the certainty of your conclusions.

GENERAL MITCHELL. Give us the warships to attack and come and watch it.

MR. SLEMP. How much money would you need for demonstration purposes?

GENERAL MITCHELL. We need no money to demonstrate the proposition; all we want are the targets and to have you watch it.

MR. SLEMP. How are you going to demonstrate that your proposition is right, and that if it is correct, that that is the course to be pursued? You will save millions of dollars if you can demonstrate it. How much money do you want for that purpose? How many vessels do you need for these experimental purposes?

GENERAL MITCHELL. We need nothing for demonstration which we have not at present. We need $17,000,000 to equip the units now existing with modern and safe airplanes. Those we have on hand now are obsolete, old, and becoming unsafe. We have got to have tactical units in the air to be able to fight, just as you have to have a battalion of infantry. We only ask enough for one unit of each class of aviation. If you do not see fit to grant it, remember that what we have learned during the war will be lost very largely because it will not be kept up.

MR. SLEMP. Suppose you demonstrate that with the vessels you now have; then you do not need any more vessels?

GENERAL MITCHELL. We need the airplanes for what was demonstrated time and time again in the European War, and only for one unit of each kind. If you do not authorize it, we shall lose all we learned in the war. It will have the same effect—except worse— of not allowing any rifles for a battalion of infantry, no cannon for a battery of artillery, and no horses for a troop of cavalry.

MR. SLEMP (Interposing). I am talking about hitting naval vessels.

GENERAL MITCHELL. If you want a demonstration of the effect of bombardment against a naval vessel, we are prepared to give you that demonstration now.

MR. SISSON. When could you make a demonstration of such an experiment as you have in mind?

GENERAL MITCHELL. At any time you wanted to do it—tomorrow, if you wish.

MR. ANTHONY. Why has not that been done?

GENERAL MITCHELL. The Army and the Navy have not seen fit to do it. The Navy conducted their own trials, and they have turned a ship over to the Army to have it shot at with coast artillery guns. I have requested repeatedly to have a war vessel turned over to us, but they evidently have not considered it necessary. They think that these tests they have had were sufficient. But we, in the Air Service, do not think they were. We want to demonstrate to a committee of Congress what we can do now and what we can do with a development of aircraft and armament in the future.

MR. ANTHONY. You would recommend that a vessel of the Navy be turned over to you to make such experiments?

GENERAL MITCHELL. Yes, sir, both armored and unarmored vessels. Armored vessels cannot exist without their unarmored auxiliaries. There are plenty of vessels now that can be used for this purpose.

MR. ANTHONY. The point of difference between you and me is just this, that I believe theoretically your proposition is all right, but from a practical standpoint I do not believe you could hit a hostile ship under battle conditions with such an explosive as would be necessary to destroy it.

GENERAL MITCHELL. All we want is an opportunity to demonstrate it.

What we need behind the Atlantic Coast is a brigade of 600 airplanes—60 per cent pursuit, 20 per cent attack, and 20 per cent bombardment; behind the Pacific Coast a brigade of 600 airplanes similarly organized, and, throughout the country in general, an air division of two brigades of 1200 airplanes that can be shifted either way—or an offensive force of 2400 airplanes. As an auxiliary to these, for observation along our coasts and frontiers, there should be 17 surveillance flights of six airplanes each—or 102 airplanes—deployed at 200-mile intervals along our coasts, for the purpose of surveillance and reconnoissance off the coasts, both for the Air Force, the Army, and the Coast Defense. This makes a total of 2502. For observation purposes, the Army and Navy combined will need not to exceed 700 airplanes if efficiently organized and applied. Or a total force of some 3202 airplanes—about the same air force that France now has. A committee of officers not belonging to the Air Service but who had extensive experience in the war in Europe recently recommended that our air force should consist of 3800 airplanes. In my opinion, this force should be one-sixth with the colors and five-sixths reserves. On the basis of a construction program of $45,000,000 a year, which is the cost of one battleship, this force can be built up and made efficient within three years. In other words, if you will turn over to a united air force what has been made available for aviation during this year, this air force can be constituted and maintained.

I want it to be distinctly understood that I do not consider that the air force is to be considered as in any sense supplanting the Army. You have always got to come to man power as the ultimate thing, but we do believe that the air force will control all the communications, and that it will have a very great effect on the land troops, and a decisive one against a navy.

During the battle of St. Mihiel, there were several instances where we scattered troops on the ground, assisting the infantry distinctly in capturing them.

In the middle of October, 1918, Gen. Pershing told me there was a big concentration of troops and he asked me if we could not use bombs against them to stop a counter attack taking place a few miles northwest of Verdun. We put one formation of 320 ships over for bombardment, with pursuit ships to protect them, and we dropped 32 tons of bombs in that area, and no counter attack ever took place at all, and we did not lose a ship, but shot down 12 enemy ships during the attack in spite of the German anti-aircraft fire and pursuit attack.

We dropped 69 tons of bombs in 24 hours that day in the area of the First Army, on that particular place, and on their centers of concentration by day and night. This was the heaviest bombardment attack ever made. Today, with the same number of airplanes of modern type, we could drop over 300 tons, or 300,000 pounds of explosive, which is fifty per cent of our bombs. Allowing 15 pounds with twenty per cent of explosive for a 3-inch cannon would require 100,000 rounds, or 1,500,000 pounds of projectiles. We bombed the centers of concentration first to interrupt the communications through these centers, which was done to a great extent; and second, to make them defend that particular part of the line with their pursuit airplanes to keep them away from our lines. The best criterion of the effect of bombardment against any place is the vigor with which they defend it. They concentrated all of their pursuit aviation over three places—over Grand Pre, over Romagne, and in the vicinity and down the river from Sedan all the time. As to specific instances, we hit railroad trains loaded with ammunition at Longuyon, and there were trains of troops on each side; 550 men were killed according to the German report, and a corresponding number wounded. One day, one of our bombardment squadrons hit in a division of troops and killed 260 and wounded a corresponding number. I have seen an ammunition factory hit with two bombs, destroying it for the war. The bombardment against the city of Nancy caused the complete evacuation of that city. We hear a great deal about non-effective bombardments.

MR. ANTHONY. Has not a board recently appointed for the purpose found that it was impracticable to prepare this country for war in time of peace, and that it was more practicable after the declaration of war to develop the air program?

GENERAL MITCHELL. There was a board which recommended an air program of 3800 planes and 24 airships to be prepared in time of peace.

MR. ANTHONY. Of the three types of ships which you are asking for, which is the most essential?

GENERAL MITCHELL. Of course, the pursuit ship is the most essential always because you cannot control the air without the pursuit ships.

MR. ANTHONY. That is the first thing you ought to have?

GENERAL MITCHELL. Yes, sir, and the next is the bombardment ship and the next is the attack ship.

MR. ANTHONY. We gave you $33,000,000 last year for Army aviation. In case Congress does not see fit to go beyond that figure this year, how ought this production program be arranged to fit in?

GENERAL MITCHELL. We have prepared the following estimate on that subject.

Instruction and operating of Air Service troops, including equipment required for their maintenance .	$ 4,432,704
Improvement of stations, shops and repairs	2,356,542
Miscellaneous supplies, printing and stationery, tuition at schools, mileage on aviation duty	510,214
Fuel and lubricants	3,507,059
Helium development	875,250
New aircraft and engines	9,045,025
Engineering, development of aircraft (McCook Field).	5,750,000
Civilian employes required for maintenance of mechanical instruction, as aeronautical mechanics, in the office of the Chief of Air Service, (as consulting engineers) and the necessary traveling expenses ..	6,523,206
TOTAL	$33,000,000

The detail for each one of these items has been submitted to the Committee with the exception of the $9,045,025 for the construction of new aircraft, which would be a proportinate scaling down of the $17,000,000,-00 asked for as being the proper amount of money required for the equipment of existing units, and, on this basis, about one-half of our existing heavier-than-air units can be equipped with up-to-date airplanes.

I wish here to be distinctly understood that the Air Service now authorized for the Army is entirely inadequate for functioning with the existing authorized Army, or in the event of any serious field operation.

Economy and Aerial Defense

Aeronautics Has Introduced a New Element into Warfare and Has Carried Warfare Into a New Element.

"We've reached the epoch—prodigious in its advent—when positively *the Air commands* and dominates both Land and Sea. * * * The air commands the water. *Unless all warships can get under the water they will be blown out of the water.*"—Lord Fisher.

"The Arm that will serve the enemy will be that arm that is the newest, the most sudden and most terrible—*the airplane.*" —Marshall Foch.

"The battleship is dead. *The future is with the airplane.*"—Admiral Sir Percy Scott.

One battleship with its necessary tenders and complete armament costs from $40,000,000 to $45,000,000. The latest proposal is to allow $4,000,000 for aircraft construction for the Air Service for one year, or one-tenth the cost of a battleship. This "economy" of expenditure in view of the editorial comment of American and foreign papers is against the best advice of those whose positions do not require them to follow departmental policy.

The Big Ship Controversy

[*From Flight (London) January 6, 1921*]

We have naturally followed the controversy relating to the future of our naval shipbuilding policy with more than a little interest, but the more we read the more are we reminded of the proverb which asks: "Who shall decide when doctors disagree?" It is practically impossible for the lay mind to arrive at anything like a settled opinion after reading the columns of print which are contributed to the daily press by distinguished retired admirals and senior officers of the Navy, each one of whom appears to have his own ideas and conceptions of how the future sea wars will be fought and won.

The worst of it all is, from the point of view of the outsider who strives for enlightenment, that every letter he reads seems to smack of special pleading, an impression which is very often strengthened when the record of the writer is looked up and it is found that he is a distinguished specialist in the particular branch of the service upon which he apparently pins his faith. Naturally, it is expecting a great deal when we ask the submarine specialist to admit that the future of naval war lies in the hands of the big ships. Nor is it logical to expect an officer whose principal service has been in battle-ships to agree with the school which avers that the big ship cannot put to sea in the face of the submarine menace, and cannot even remain safely in harbor because of her vulnerability to attack by torpedo-carrying aircraft.

Hence the only way to arrive at conclusions is by careful reading and weighing of all that is said on every aspect of the question,, and a careful elimination of all that seems biased by the known service and inclinations of the witness. The tendency we have in mind is well demonstrated by the fact, to which Admiral S. S. Hall draws attention in a letter to *The Times*, that the controversy has largely been reduced to a discussion of the respective merits of the battle-ship and the submarine. The share which aircraft are likely to take in the naval battles of the future, he points out, is ignored or dismissed with little more than a reference. Admiral Hall, after pinning his faith to "thoroughly efficient air, submarine and mining services," concludes his views with the very emphatic pronouncement: "It is air mastery alone that can give us the power of a vigorous offensive."

General Brancker sums up the case quite well when he says —also in *The Times*—after reviewing the claims made by all sides: "Some writers have stated that the duty of the fleet is to destroy the enemy's sea bases, coaling stations, fortifications and commercial harbors, and others have contended that submarines have rendered such enterprises impossible. But they will *not* be impossible to aircraft, and I am certain that, in the future, the Air Force must become *par excellence* the arm of offence against hostile commerce and territory. If this high allotment to the Air renders the allotment to the Navy insufficient for the construction of capital ships, then they *must* go. No nation can neglect power in the air in order to preserve a form of defense so expensive in its maintenance and so problematical in its utility."

Naturally, we incline very much to the endorsement of Admiral Hall's and of General Brancker's views, and we believe that before many decades there will be few who will not be of the same way of thinking.

By the way of a last "view" of the future the following sentence from a New Year's article in the German paper, *Die Woche*, should give food for reflection:

"The capability of ships to submerge marks a new era in the waging of warfare which is of the highest importance. It can never again be left out of calculation, any more than can the mastery of the air by airships and airplanes."

It would really seem to us that the matter has now arrived at a stage when it can best be judged by an able civilian committee, capable of sifting the whole of the evidence, etc., free from professional bias, and qualified to arrive at reasoned conclusions, which must be forced upon the professional seamen whether they agree with those conclusions or not.

The Navy Building Program

[*From the New York Tribune, January 27, 1921*]

The policy of building battle-ships and cruisers for the Navy is now under consideration by Congress. A wise decision is of vital interest to the country.

There are eleven super-dreadnoughts under construction. Two of these, the *California* and the *Maryland*, are so near completion that they should be added to the fleet. The *Colorado*, the *Washington* and the *West Virginia* are well advanced. These three, with the *Maryland*, would form a strong

division of 16-inch-gun ships. Their completion may be justified.

The remaining six dreadnoughts are less than 25 per cent complete. In view of the menace to battle-ships of present type from submarine and air attack, the completion of these six ships may be very unwise. It would seem sound policy to stop work on them for the present. It may be necessary in view of the *Indiana* experiment to provide them with an armored deck to protect them from bombing attack. Or if their construction is delayed for a time, it may be advisable to complete them as carriers of heavy bombing and torpedo planes. We are sadly in need of such types. An officer of distinction declares:

"There can be no doubt that *The Tribune's* idea of a three-plane fleet is correct, and that what we need now is to put emphasis upon the upper and lower planes. We have enough of the surface plane at the present time. I would even like to see the building of some of our battle-ships abandoned to make money available for these auxiliary purposes."

In addition to eleven dreadnoughts, there are six big battle-cruisers building. When originally designed, the need of these ships was generally recognized. But today their utility is decidedly questioned at home and abroad. Inasmuch as their construction is only just begun—they are not more than 10 per cent complete—it is believed that work upon these ships, as at present designed, should stop until the paramount needs of the fleet and the governing influence of new weapons are carefully considered.

It is important to note that the hull and machinery of incompleted battle-ships and battle-cruisers may be fully utilized and all waste prevented if these ships are ultimately transformed into modern airplane and torpedo plane carriers to bring our fleet to a proper standard of efficiency in aviation. One of the ablest officers in our navy says: "It may be that within a reasonable time it will be realized that an airplane carrier, able to steam at 35 knots and to carry ten torpedo planes and twenty fighting planes, is a capital ship and is more powerful as an offensive weapon than any other type of capital ship can be."

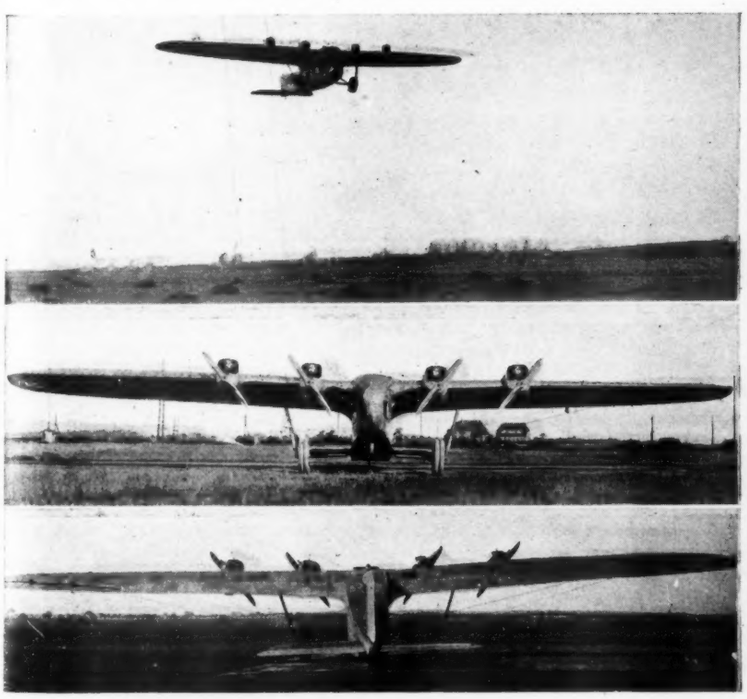
So much for the big ship program. There are ten scout-cruisers building, many of them well advanced. They should be completed regardless of the battle-ship policy. We need some fast surface ships in the fleet.

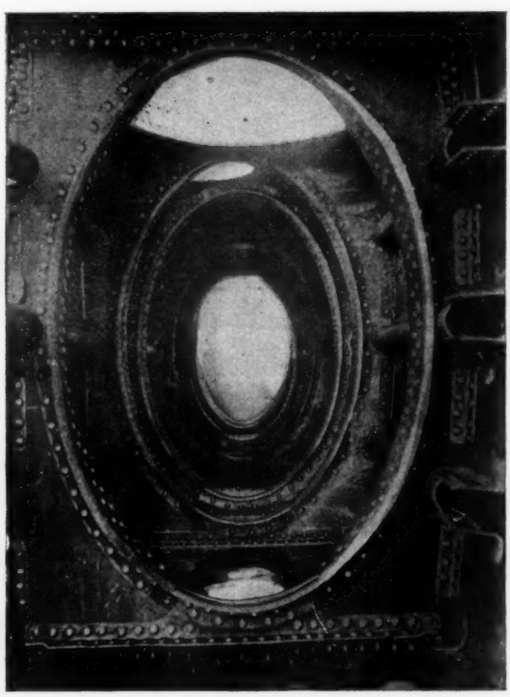
It is manifest that the forty-seven submarines are sadly needed. There are no modern submarines in our fleet today. We will be more or less helpless without them.

There is but one safe and sane policy. We must not be satisfied with a navy that would have been strong in 1916. We want a navy that will be strong in 1922 and in the years to come. Congress should immediately appoint a committee to investigate this subject thoroughly, and the committee should call officers to testify frankly and fearlessly. By doing this we may save hundreds of millions in providing a modern three-plane navy.

The Zeppelin Staaken Airplane

Three views of the Staaken duralumin monoplane are shown herewith. This is one of the few ships which the Interallied Aeronautical Commission of Control has allowed the Germans to proceed with. This machine has made a dozen trial flights and is being put into final shape.





VIEWS OF THE ZEPPELIN STAAKEN AIRPLANE: IN FLIGHT, FRONT, REAR, AND SECTION THROUGH THE FUSELAGE SHOWING CONSTRUCTION

It is interesting to note that while the monoplane structure is used, it is not internally braced, lift wires being used for flying load, while for inverted loads the wing takes care of itself.

One of the interesting features of this machine is the remarkably clean chassis. Apparently the one heavy strut on either side is used to take the bulk of the vertical load and the shock absorbers are part of these vertical load struts. There are then but four other struts used for the chassis. These struts are almost in horizontal position and are no doubt used as sway braces and to take up horizontal load on the chassis in meeting obstructions. Presumably universal joints are provided at either end of these latter struts. On trial the landing gear proved insufficiently strong, for it gave way on landing.

It is understood that the construction of the machine is such that a mechanic can make his way to the engines.

The Z.R.-2 May Cross Atlantic in May

The Z.R.-2, formerly the R.-38, which the United States Navy is having built in England, and which is the largest airship ever constructed, will be flown to the United States late in May or early in June, according to plans being made by Naval Aviation in Washington.

This flight will be the most important thus far in aeronautics. There is hope—and a slight possibility—that the great dirigible, instead of stopping in New Jersey, will continue on to the Pacific Coast, without pause, thus making on the maiden voyage a non-stop record of approximately 8,000 miles.

Almost one-third larger, far more powerful, and with twice the cruising range of the R.-34, which in 1919 made the round trip of the Atlantic Ocean, after laying over several days on Long Island, the Z.R.-2 undoubtedly is capable of the unbroken flight from England to California.

At all events it is definitely known that the Z.R.-2 will make the trans-Atlantic flight about the time indicated above. The arrangements which Naval Aviation are making are being followed eagerly by civilians interested in projected commercial airship lines. Plans for several such undertakings are under way, all of them more or less directly delayed by the lack of an aerial code in this country and also the lack of comprehensive operating and meteorological data.

Capt. T. T. Craven, Director of Naval Aviation, expects to be able, through the information gathered on the Z.R.-2's trip over and on subsequent voyages from city to city in the United States, to provide considerable stimulus to commercial aeronauties. He says that federal regulation of aerial traffic should be provided before the airship arrives.

"It is hoped that the present Congress will not wait until Naval Aviation's airship arrives before it provides an aerial law," said Captain Craven. "There is in existence the world's largest airship, practically ready for operation, yet there are no 'rules of the road.' Rules making for the safety of life and property in the air and on the earth or sea are absolutely essential before aeronauties in America can be properly developed.

"Naval Aviation desires to aid commercial aviation. We are in need of equipment and personnel, but such as we have are being utilized. We understand that the European nations, since the armistice, have been somewhat at a loss to know how to make their defensive aeronautical material useful in time of peace. We have decided that the best results can be obtained by making available to American commercial aeronautics all that we learn scientifically and practically in bringing the Z.R.-2 to the United States.

"We hope that the Z.R.-2 will be but one of a series which we regard as necessary to the proper development of the Air Force. But back of this Air Force there must be a civilian reserve. It is expected that what is learned through our operation of the Z.R.-2 will indicate adaptable airship routes and suitable terminal facilities, and, above all, that it will develop in the American mind the consciousness that aviation is desirable in business development and necessary in national defense."

The R.-38 was taken over by Naval Aviation from the British Government when the airship was in its early stages of construction. It is understood that the price was around £500,000. It was immediately renamed the Z.R.-2, the letter "Z" being the Navy key to lighter-than-air and the letter "R" indicating "rigid". Z.R.-1 is a somewhat similar ship which was designed by the Bureau of Construction and Repair and work on which has been begun.

The Naval Air Station at Cape May, N. J., developed during the war, has been indicated as the Atlantic terminal for the Z.R.-2 and at this point a great hangar to house the airship is being constructed. Another hangar, in which the Z.R.-1 will be assembled, is being built at Lakehurst, N. J.

The Z.R.-2 is rapidly nearing completion at the Royal Airship Works, Cardington, Bedford, England. Its engines are being built at the Sunbeam Motor Works, Wolverhampton, England. The latest information which Naval Aviation has received indicates that the Z.R.-2 will probably be able to take the air this month.

For many months Naval Aviation has had a lighter-than-air detachment consisting of 72 officers and men under instruction in England. The party is under Commander L. H. Maxfield. Arrangements in this country are being made by Lieutenant Commander Zachary Lansdowne, who is Captain Craven's aide for lighter-than-air. For many weeks Commander Maxfield and his American staff have had sole charge of the British airship R.-32, sister ship of the R.34, and have been flying it on many trips through the British Isles. This experience has qualified the detachment to take over the Z.R.-2, immediately on its completion, and navigate it to America.

Commander Maxfield has just sent to Naval Aviation a remarkable account of the operations of the R.-32 which undoubtedly forecasts the routine which will be followed during the forthcoming flight of the Z.R.-2.

It is stated that the new American airship is approximately 700 ft. long and more than 85 ft. in diameter. It has a gas capacity of 2,720,000 cu. ft., as against 2,000,000 cu. ft. in the R.-34. The disposable lift of the Z.R.-2 is about 45 tons, while that of the R.-34 is only about 25 tons. This means that the Z.R.-2 is approximately one-third larger and has twice the cruising range. It has a maximum speed of 69 or 70 miles an hour but probably will throttle its six engines down to about 60 miles.

In order to fit themselves for this epochal flight, Commander Maxfield's detachment underwent training consisting of lectures, both theoretical and practical, on all subjects pertaining to the care maintenance and operation of rigid airships, and then undertook practical work along the same lines. As instruction progressed and theoretical work was finished, lectures by American officers in navigation, tactics, strategy and other naval subjects were added.

Aeronautical Society of Alabama

Organization of the Aeronautical Society of Alabama is going forward with rapidity, two new members of the board of governors being added last week. They are E. W. Barrett, editor of the Birmingham *Age-Herald,* and John Henley, of the Birmingham Publishing Co.

Lieut. C. W. Tyndall, who will have charge of the organization of the club throughout Alabama, has returned to Birmingham from New York, where he has been in conference with officials of the Aero Club of America.

The new balloon recently ordered by the club has been completed by the Goodyear Tire & Rubber Co. at Akron, Ohio, and is expected to reach Birmingham within a few days. The balloon is the first of the extensive equipment of balloons and airplanes which will be purchased by the club in the near future.

Officials of the Aero Club of America are watching with interest this, the newest branch of the national club, Lieut. Tyndall reports, and stand ready to lend all possible assistance to the local aeronautical enthusiasts.

Members of the board of governors will meet shortly to further perfect the organization. The organization force is being concentrated in Birmingham for the present, but the activities will be extended throughout the state as soon as the organization is in working order.

Minnesota Air Squadron Authorized

Authorization for inspection and recognition of the First Minnesota Observation squadron was received January 3 from the War Department, it was announced by Lieut. Col. W. C. Garis, commanding officer. This, it is expected, will be done promptly by Maj. H. A. Rader, Air Service Officer, Seventh Army Corps Area, headquarters at Omaha.

Fourteen men still are needed to complete the squadron's personnel. Included are three cooks, two buglers, one communications officer to rank as second lieutenant and eight enlisted men.

Plant of the Aeromarine Plane and Motor Co.

By Alexander Klemin

Consulting Engineer

One of the airplane factories bearing the highest reputation in this country and also one of the best equipped plants for building either planes or engines is that of the Aeromarine Plane and Motor Co at Keyport, N. J. It is situated in a well sheltered part of Raritan Bay, in an ideal location for a factory building both land and water craft. The factory faces the bay, and near the factory is protected water, which is ideal for the launching or testing of seaplanes. Running parallel to the bay and immediately adjacent to the factory is an absolutely flat gravel covered expanse of 1800 to 2000 feet long, 400 feet wide. Good flying country surrounds the plant and the government aviation field, Camp Vail, at Little Silver, is near by.

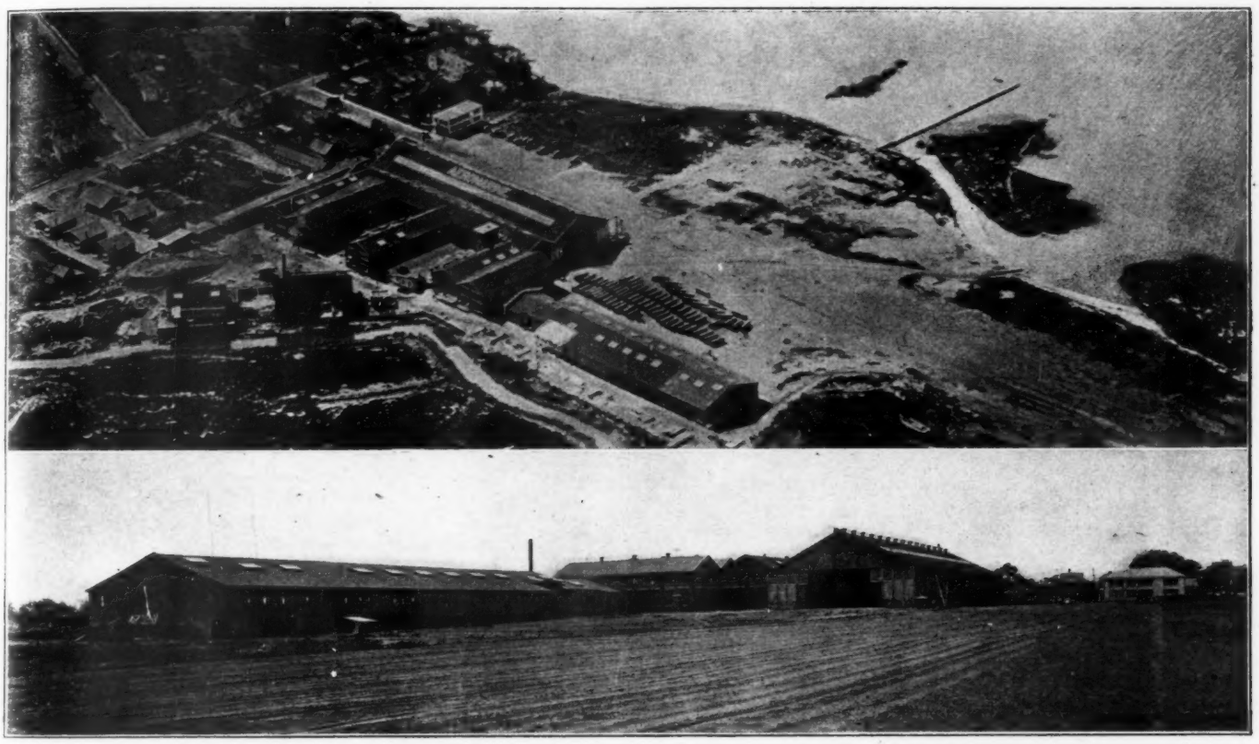
The plant is 19 miles from New York by water route and ten minutes by trolley from Matawan, N. J., a station on the Pennsylvania Railroad and the Central Railroad of New Jersey. Keyport is a small town of some five thousand or six thousand people, with many industrial concerns, such as the Reliance Tire and Rubber Co., the Whitehall-Tatum Co., and other important companies. There is no scarcity of skilled labor, as mechanics prefer to work in Keyport and own their homes to the crowded conditions of the city.

Types of Aircraft and Motors Built by the Aeromarine

The factory since its inception has been kept occupied with designing and building government airplanes, but still has found time to produce several well known types of flying boats for commercial purposes. Previous to the war it manufactured several experimental machines for the U. S. Army. During the war it produced 250 Models 39-A and 39-B single float training seaplanes and 50 Model 40 flying boats for training purposes.

Since the war a great deal of time has been devoted to the production of commercial aircraft. Well known types, such as the Model 75 Aeromarine Navy Cruiser with a capacity for eleven passengers, crew and four hours fuel; the Models 40 and 50 types, two and three place open and closed flying boats, which were exhibited at various aeronautical expositions, are manufactured commercially.

Recently the company has taken over the distribution and conversion for commercial purposes of 135 Model HS-2 Navy Liberty motored flying boats, one a Model 85 having been recently exhibited at Gimbel Bros., New York.



ABOVE: THE AEROMARINE FACTORY FROM THE AIR; KEYPORT IS IN THE BACKGROUND.
BELOW: VIEW OF FACTORY FROM THE LANDING FIELD

The Aeromarine types B-8, 150 horsepower; U-8-D, 180 horsepower; and U-6-D, 130 horsepower engines have been produced commercially after eight years of experimental work on these and other types.

General Layout of Plant

From the photographs it can be seen that the factory has been built on sound lines. The various departments are closely interconnected, and every facility is offered for moving of raw material from the stock room to the wood mill or to a machine shop, and from the shops to the final assembly.

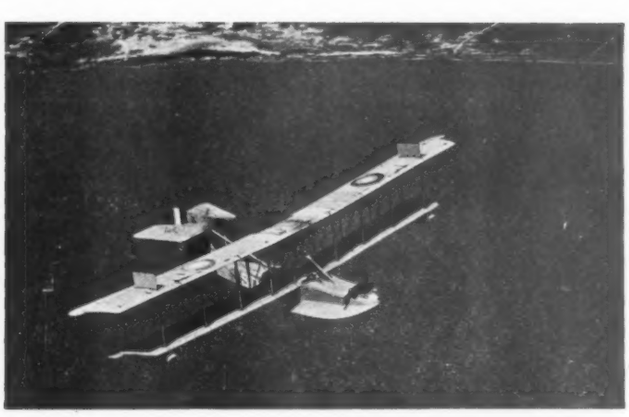
The total floor space of the factory is about 130,000 square feet. The company during the war employed 1200 men. Under peace time conditions the general equipment and facilities have been increased. The number of men employed is somewhat smaller, but can be readily augmented to meet the demands of commercial flying developments.

Materials Laboratory

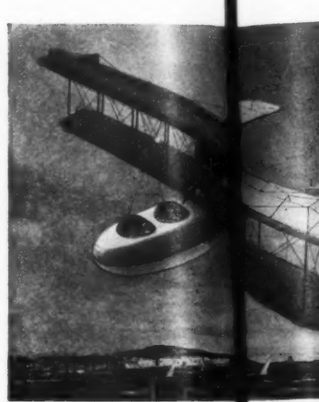
The Aeromarine company's engineers attach considerable importance to a study and inspection of materials. Accordingly, in between the main stock room and the assembly room a small but well equipped materials laboratory is provided. This is finished with complete chemical equipment for the anal-

Every wide awake pilot can make ney
passenger Aeromarine Navy HS-2 g B
compression Liberty motor for one- of
it. Your operating cost for fuel, pil d n
Your possible revenue is from $250.0 $30
a handsome profit, after allowing ally

The Aeromarine Company has invested hundreds of sand for commercial purposes. All of this valuable exper is at flying boats. Organize an airline in your town. Othe get act today. The Canadian Government last July selected one of these Navy r all o



Navy HS-2-L Flying Boat (Unconverted) F. O. B. Naval Base, Philadelphia, New York, Pensacola and San Diego
Price $6,160.00. Immediate delivery



Aeromarine-Navy HS-2-L Six Se it Flying B
Price $6,500. te delivery

Aeromarine Sales Service includes the securing of reliable pilots and mechanics

Aeromarine

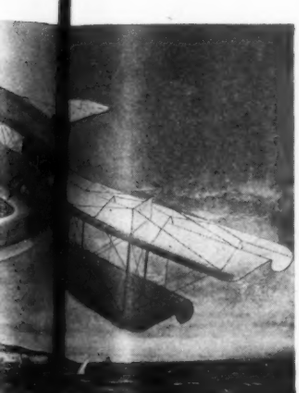
Wire Wte

Aeromarine Enginee n

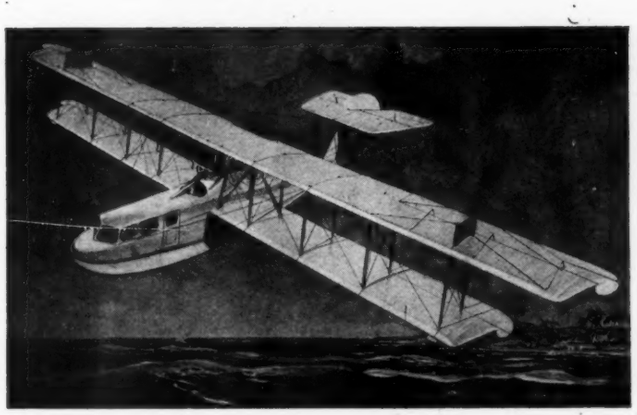
1800 TIMES BUILDING **PHONES BRYA 45**

ke ney this year. You can buy a six
2 g Boat equipped with 350 HP. low
e- of what it would now cost to build
ilo d mechanic is $16.00 per flying hour.
0.0 $300.00 per flying hour. This shows
g lly for overhead and depreciation.

s of sands of dollars in successfully operating flying boats
per is at the disposal of companies operating Aeromarine
the getting busy. The supply of boats is limited. Better
lavy er all other allied aircraft to make the long flight between Cochrane and Hudson Bay.



L Six Se it Flying Boat, Model No. 85
$6,500.0 e delivery



Aeromarine-Navy HS-2-L Enclosed Cabin De Luxe Flying Limousine,
Model No. 80
Price $9,000.00. Immediate delivery

An easy payment plan makes it possible to pay for these boats, in part, out of their earnings

erc ine

Wte

Phone

e ng & Sales Co., Inc.

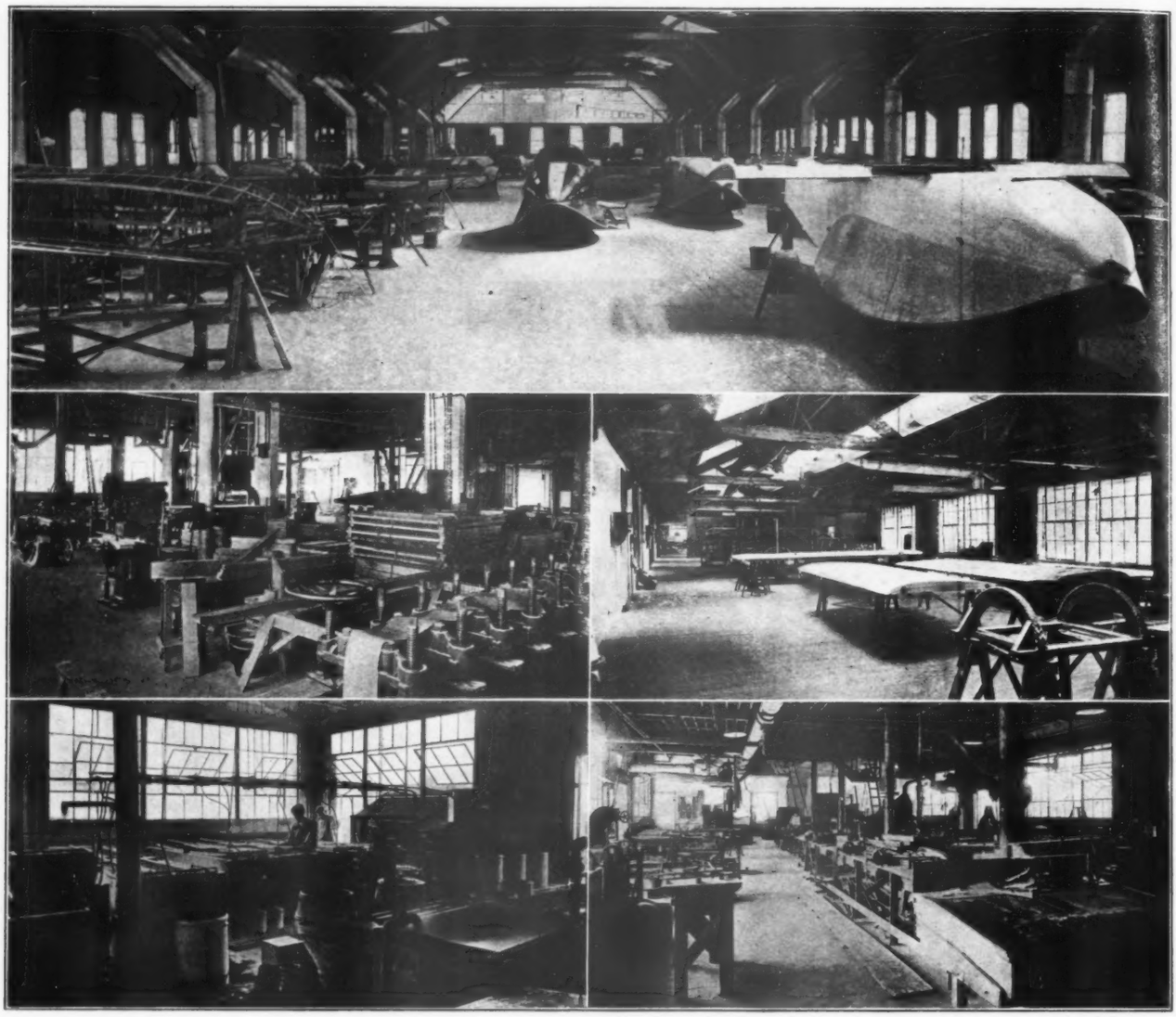
YA 4505 or 6147

NEW YORK CITY

ysis of steel. A Tinius Olsen testing machine can exert a load of 50,000 pounds maximum and take a strut 8 feet 6 inches in compression and a test specimen 6 feet 6 inches in tension.

The equipment also includes a small electrical furnace from Eimer & Amend, New York, constructed on the multiple unit system so that one set of coils can be replaced without the furnace being put out of commission.

A very interesting item is a simple apparatus for experimental heat treatment. A small Bunsen burner under a nitrate bath is provided in which a temperature of 900 deg. F. can be obtained in 20 minutes, and experiments on the heat treatment of Duralumin are easily conducted.



THE AEROMARINE HULL SHOP; THE CONSTRUCTION FORMS ARE SHOWN ON THE LEFT
THE WOOD MILL AND GLUE PRESS — THE COVERING DEPARTMENT
THE PLATING ROOM — THE WELDING AND BRAZING ROOM

Wood Shop

The wood mill is particularly well and completely equipped for every kind of wood work which is likely to occur in an airplane factory. Special glue presses are provided for laminated wood beams, as can be seen in the photograph. Some of the machines include a mortising machine from J. A. Fay & Egan Co., Cincinnati and a mechanical operating sand paper machine of the Mattison Sand Papering Co., Beloit, Wis. An interesting piece of equipment is the Mattison automatic strut shaping equipment. Stationary knives act on a revolving strut which, with proper cam arrangement, allows 100 struts a day to be shaped. The American Woodworking Machine Co., Williamsport, Pa., provides some of the band saws, horizontal planers and similar machines.

The wood shop has a clear floor space of about 100 x 100 feet. In connection with the wood mill a large dry kiln is in operation.

Hull Shop

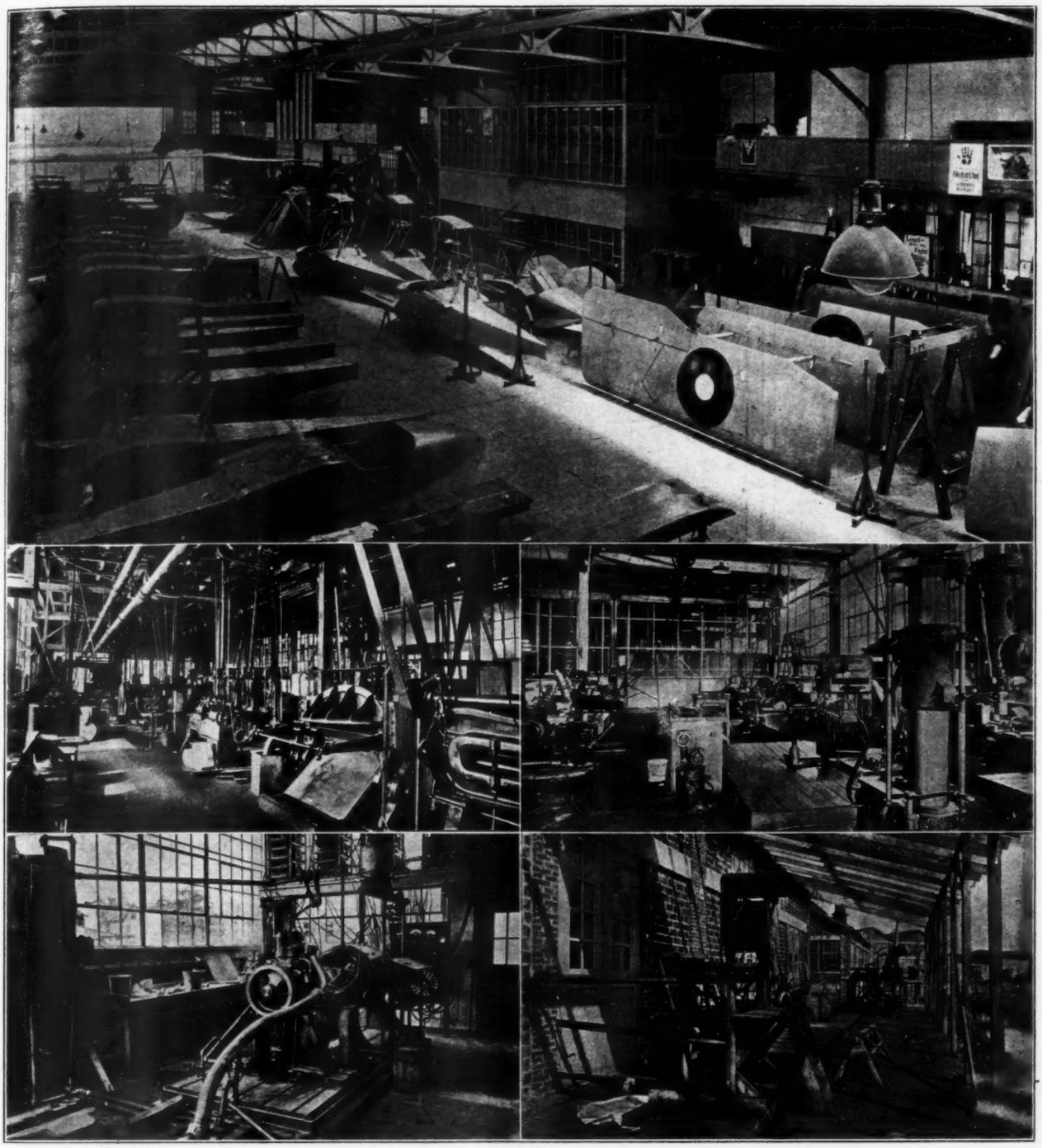
The hull shop is a room 200 feet long by 60 feet wide with a head clearance of 18 feet. The floor space is entirely clear. Paint and varnish stock rooms are placed on the floor at about the center of the shop. In the upstairs galleries are the pattern shops. Hulls are built invariably on forms, which are essential to quantity production and uniformity of manufacture.

Adjoining the boat shop is the covering department. A stock room at the end of the hull shop has all parts and frames cut to shape and numbered ready for assembly. The complete hull is taken out directly from the boat shop to the final assembly.

Plating Department

One of the most important parts of the equipment of an airplane factory is the plating room for metal parts, such as fittings, metal struts, etc. The plating room of the Aeromarine Plane and Motor Co. includes five baths with a maximum length of 10 feet, built solidly into the ground, where all plating can be carried out in accordance with Army and Navy specifications.

There is a self contained generator set and a switchboard allowing for fine regulation of the current. Two rotary platers, one of which is shown in the extreme left of the photograph, are supplied by Hanson and VanWinkle Co., Newark, N. J. These rotary platers are extremely efficient for small parts.



THE FINAL AIRCRAFT ASSEMBLY ROOM IN THE AEROMARINE FACTORY
A VIEW OF MACHINE SHOP — MACHINE SHOP, MOTOR DEPARTMENT
THE DYNAMOMETER ROOM — MOTOR TEST PLATFORM AND TORQUE STANDS

Welding Department

The welding department includes a barrel sand blast machine, emery turning machine, a dip brazing outfit, and a Thompson spot welder, used for spot welding before furnace brazing. A heat treatment furnace with a ten-foot length limit is also part of the equipment. In connection with this department a complete acetylene generating plant is operated, which is housed in a separate fire proof building.

Final Assembly Room

The final aircraft assembly is a beautifully lighted ventilated and heated room some 300 feet long by 80 feet wide with a 30-foot clearance to the roof truss light and heat. It carries ample galleries on three sides, which constitute storage space for finished and surplus parts, in addition to the particularly well located finished parts stock room shown in the back center of the illustration.

At the end of the shop there are sliding doors with 60 by 30

foot clearance, so that a machine as large as an F-5-L, can be taken out on a roller truck and launched right at the factory doors, making a "fly away" delivery. One could scarcely ask for a better shop for final assembly of the largest aircraft. Six of these F-5-L flying boats have already been converted for commercial flying purposes. One is ready for delivery, one is under construction and two are contemplated. One plane of this type is equivalent to five planes of the DH type.

Propeller Department

A special propeller department is included in the plant and all propellers are designed and built at the factory. No cutting machines are employed; all propellers are custom-built to suit exact requirements. The usual full equipment is carried.

Machine Shop and Motor Department

The machine shop equipment is necessarily large to facilitate the manufacture of the four types of motors produced by this company as is shown by the photographs illustrating it. The maintenance of such a shop is of great advantage to the aircraft division and such a large and varied machine shop equipment is neither justified nor found in the average aircraft factory.

Among the equipment are a number of grinding machines of various types including, a disc grinder with a grinding surface approximately five feet in diameter, manufactured by the Chas. H. Besly Co., Chicago, Ill.; a cylinder sleeve grinder built by the Bryant Chucking Grinder Co., Springfield, Vt.; and a crankshaft grinder furnished by the Landis Tool Co., Waynesboro, Pa.; also several other smaller types of machines for various uses.

The lathe equipment is particularly complete, there being a crankshaft lathe of the heavy duty type built by the R. K. Le Blond Machine Tool Co., Cincinnati, Ohio, and other engine lathes built by the American Tool Works, Cincinnati, Ohio. Milling machines of various sizes are furnished by the Cincinnati Milling Machine Co., Cincinnati, Ohio, Van Norman Machine Co., Springfield, Mass. and the Briggs type millers built by Gooley & Edlund, Inc., Cortland, N. Y.

Bolts and small parts are made on Gridley automatics built by the National-Acme Co., Cleveland, Ohio, and for larger bar and chucking work automatics made by, Jones and Lamson Machine Co., Springfield, Vt. and Acme Machine Tool Co., Cincinnati, Ohio.

The drill press equipment varies from large radial drill Tool Co., Cincinnati. Ohio. The necessary small shapers and other machine shop equipment are consistent with the main machines mentioned above.

A completely equipped tool crib with metal racks manufactured by the Lyon Metallic Mfg. Co., Aurora, Ill., which is also used for a finished and rough parts store room, contains a complete assortment of cutters, special tools, jigs, and fixtures, needed for minimum cost quantity production.

Punch presses varying from a 100,000-pound machine to various chopping machines are used to avoid hand work on sheet metal parts production.

Motor Testing Laboratory

The motor testing laboratory is exceptionally complete, the building being separated from the main plant and containing a dynamometer laboratory and two small assembly rooms.

The equipment is a Sprague electric dynamometer of 250 horsepower capacity. This equipment is used for tests of short duration when accurate horsepower readings, fuel consumption and other tests are desired. The outside testing platform at the rear of the test laboratory building consists of torque stands equipped to perform standard Army and Navy tests and other trials of long duration.

A mercury weighing scale of an original type is used for measuring the pull on the torque arm. The usual accurate instruments needed in such tests are available.

Courtesy Extended on Visit

Thanks are due to the general manager, the chief engineer, and staff for facilities offered on a visit to the factory of which the Aeromarine Plane and Motor Co. may be justly proud of and justifies the Aeromarine claim that they are attacking the commercial aviation problem by practical performance rather than by theoretical speculation.

U. S. Imports and Exports of Aircraft

Years Ending June 30, 1912—1920

Previous to 1912, when the classification "aeroplanes" first appears, aircraft were included in the class "all other cars, carriages, and vehicles" so far as exports are concerned. If there were any importations of these commodities they would be included in the cassification of the paragraph of the tariff law under which the import duty was assessed, according to the chief value of component material, such as iron and steel or other metal, or manufactures of wood, flax or silk.

Pioneers will recall one or two importations of balloons in 1906-7. For the international balloon races, the aerostats were brought in under bond, which was cancelled on exportation after the race. Spherical, kite and dirigible balloons would be dutiable in imports according to the component material of chief value. In the statistics they would be included in the class of component material. In exports, they would be included in the class "All other articles."

Supplies for the American Expeditionary Force abroad which were shipped overseas on Army or Navy transports were not taken account of in the official statistics of exports from the United States for the reason that these vessels are not required to enter and clear, and collectors of customs have, therefore, no record of the cargoes of such vessels.

Military supplies and material sold to the allied governments, food-stuffs, clothing and other relief supplies shipped abroad by the Food Administration and the Red Cross were mostly carried on commercial vessels and are included in the official reports of exports. Vessels operated by the United States Shipping Board, either directly or under charter, enter and clear at the custom houses, and their cargoes are included in the statistics.

	EXPORTS			IMPORTS		
	Airplanes		Parts of (Engines alone, spares, etc.)	Airplanes		Parts of (Engines alone, spares, etc.)
	No.	Value	Value	No.	Value	Value
1912	29	$ 105,805	.....	17	$ 59,713	.....
1913	29	81,750	$ 25,802	13	50,920	$ 1,776
1914	74	188,924	37,225	1	1,856	30,405
1915	152	958,019	583,427	1	2,000	2,371
1916	269	2,158,395	4,843,610	..	.....	10,531
1917	135	1,001,542	3,133,903	4	40,818	20,650
1918	20	206,120	8,877,977	..	.....	518,176
1919	51	644,600	12,216,801	4	121,218	317,339
1920	63	459,394	643,270	57	108,904	351,394
	782	5,804,549	30,362,015	97	385,429	1,306,642
		Total exports		$ 36,166,564		
		Total imports		1,692,071		

Following is a statement of aircraft shipped abroad in 1918 to the American Expeditionary Force and to the Allies. These figures probably include the items in above tabulation of which the Department of Commerce has record. It is not possible to distinguish between those recorded as exports by the Department of Commerce and those unrecorded, as to amounts, for 1918.

Aircraft and Approximate Cost Floated out of the United States during the Calendar Year 1918

Classification	Number	Value
Airplanes	2400	$ 32,321,197
engines spares, spare parts, spare instruments engine spares, spare parts, spare instruments and armament, spare propellers, etc.)		60,107,501
Balloons	441	3,528,000
Balloon Essentials (including cable, hydrogen cylinders, caustic soda, ferro silicon, etc.) ..		1,235,039
Approximate cost of aircraft floated out of the United States during calendar year 1918 ..		$ 97,191,737

Air Service records indicate that no aircraft were floated during 1919.

Monthly and quarterly summaries of imports and exports are published by the Department of Commerce, Washington, D. C.

Italian Aviation

By Lieut.-Col. Cristoforo Ferrari

Chief of Technical Division, Italian Air Service

On August 25, 1920, by initiative of His Excellency the Minister of War and of the high Commander of Aviation, the representatives of associations and firms constructing airplanes as well as representatives of the press were called in conference at Rome for an exchange of views concerning the principle questions in regard to civil aeronautics. This meeting, appropriately supplementing those which had taken place at the end of July and on the beginning of August under the auspices of the Aeronautical Consulting Commission was the cause of animated discussions. As far as the desired establishment of civil aeronautics is concerned, this meeting can be considered as one of the first public manifestations of interest on the part of the Ministry of War.

Present Italian Aeronautic Organization

On July 1, 1920, the General Department of Civil Aeronautics which was a part of the Ministry of Industries was discontinued. Its activities were assumed by the Ministry for War and came under the Aviation High Command. This Aviation High Command is divided into three branches: Military Service, Technical Services for aviation of any kind, and Civil Aviation. There are, of course, also administrative bureaus. The Aviation bureau of the Ministry of the Navy has its own aeronautical service.

In the same way in which the Army plans for troop mobilization, the government will plan for the mobilization of industries, in order to be ready to start them at the right moment, in well ordered production.

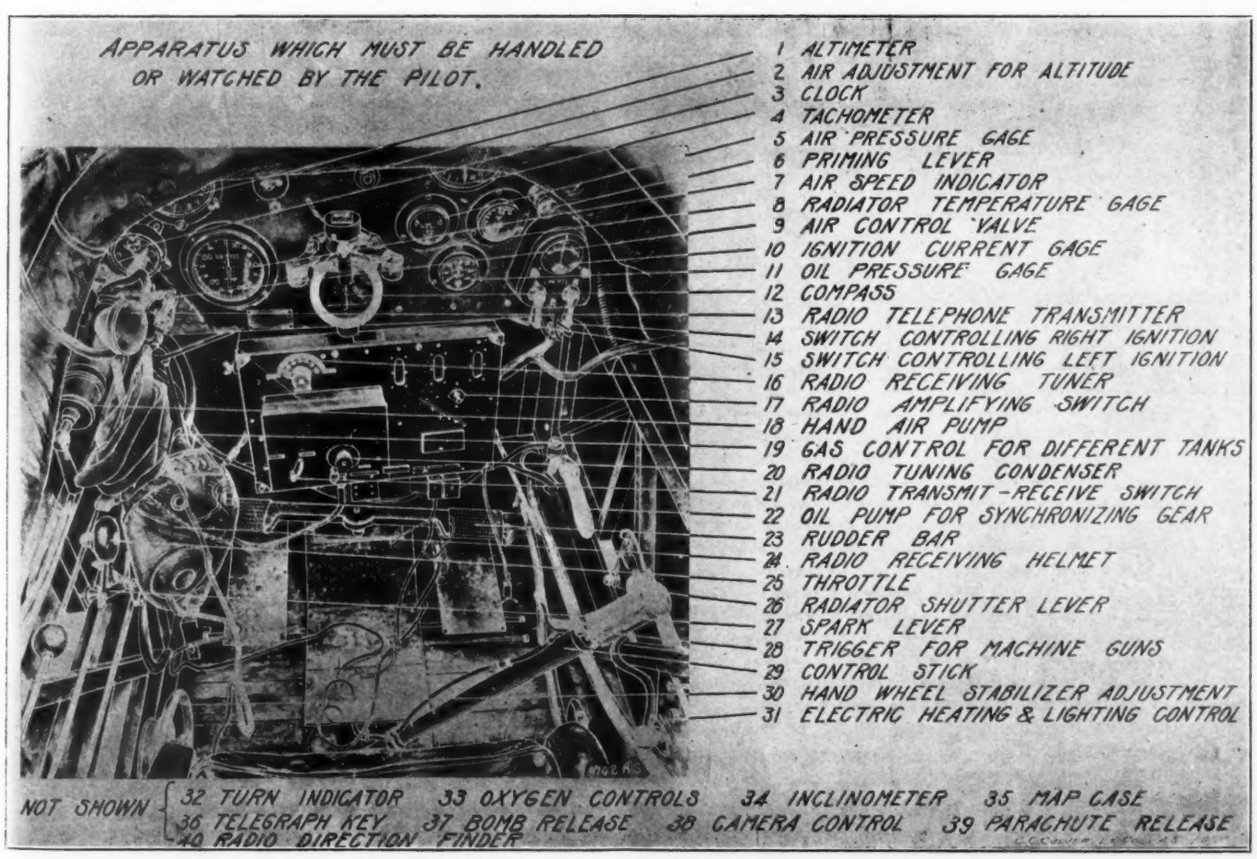
It is not advisable for military aviation to accumulate vast supplies of aircraft as types soon become obsolete and depreciate in value. Until the aeronautic industry is able to get into production it will be necessary that all classes of civil planes suitable be reconstructed in such a way as to receive armaments, bombing and torpedoing installations.

Proposal of a National Congress

It seems worth while, to consider how the new-born civil aviation may come out of the present embarrassing situation and, consider its future, growth and development. In my opinion the best way to accomplsh this, is the calling of a large national meeting or congress, open to all concerned, manufacturers, organizations, experts and students of aviation, no matter what their position may be, a conference in which the state should be officially represented. Such a congress should last as long as necessary to permit exhaustive studies and calm discussions. It might be divided into sections so that the work could be appropriately distributed, but all sections should finally come together to and state their conclusions. It should then be the task of the official representatives of the government to consider those points in which the cooperation of the state is involved.

What a Pilot Has to Watch

Prepared By Lieut.-Col. C. C. Culver, A. S.



N. A. C. A. Praises Air Mail

President Wilson has transmitted to Congress a resolution regarding the imperative necessity of continuing the Air Mail appropriation which was submitted by the National Advisory Committee for Aeronautics. The President concurred in the opinions and indorsed the recommendations for the continuance of the Air Mail Service.

Special Report of the National Advisory Committee for Aeronautics

To the CONGRESS:

The executive commitee of the National Advisory Committee for Aeronautics, at a meeting held on January 13, 1921, had under consideration the present status of the Air Mail Service of the Post Office Department and the probable effect on the development of aeronautics in America of the discontinuance of this activity, which has been threatened by the elimination on the floor of the House of the appropriation for its continuance.

It is the opinion of the National Advisory Committee for Aeronautics that the Air Mail is in effect an experimental laboratory for the development of the civil uses of aircraft, and, viewed from this angle alone, is worth what it costs over and above the value of the service it actually renders in the more rapid transportation of mail.

The sixth annual report of the National Advisory Committee for Aeronautics contained a statement of a national aviation policy, in which the need of federal encouragement for the development of commercial aeronautics was emphasized and the definite recommendation made that the Air Mail Service of the Post Office Department be further extended and developed.

The increasing relative importance of aircraft in warfare not only justifies but makes imperative the expenditure of public funds to aid the development of commercial aeronautics, on which military and naval aeronautics will be largely dependent. The Air Mail Service has given the best demonstration of the practicability of the use of aircraft for civil purposes, and, in the face of many obstacles, has accomplished remarkable results of real and permanent value to the Nation at relatively slight cost. It is the unanimous opinion of the National Advisory Committee for Aeronautics that the Air Mail Service of the Post Office Department should be continued.

The reasons for this special report are set forth in the following resolution, which was adopted without a dissenting vote on January 13, 1921:

Whereas the Air Mail Service of the Post Office Department has given to the world the best demonstration of the practicability of the uses of aircraft for civil and commercial purposes, and has greatly promoted the commercial development of aircraft; and

Whereas the development of the civil and commercial uses of aircraft is essential to the maintenance of an aircraft industry in such a condition as to permit the necessary expansion in time of war, unless the taxpayers of the country are willing to pay through Army and Navy expenditures, practically the entire cost of maintaining the industry; and

Whereas the civil development of aviation will aid military development and will in time bring about the establishment of air routes and landing fields more or less generally throughout the United States, which will be an important military asset in time of war; and

Whereas the Air Mail Service has already contributed to the progress of civilization by improving the means of business communication and transportation; and

Whereas the Army and Navy Air Services are by law limited to the development of types of aircraft for military and naval purposes which do not satisfactorily meet commercial needs; and

Whereas the needs of other civil agencies of the Government such as the Forest Service, the Coast Guard Service, the Coast and Geodetic Survey, require the development of nonmilitary types of aircraft; and

Whereas the operation of the Air Mail Service is at the present time an essential part of the organized plan for the development of commercial aviation as contained in the national aviation policy formulated by this committee, and the cost of fostering such an organized plan is much less than the waste that would inevitably result from unprepared entry into war; and

Whereas several European countries are supporting the development of commercial aviation, the discontinuance of the Air Mail Service will be a backward step in the development of aviation and will retard for a number of years the establishment of landing fields generally: Therefore, be it

Resolved, That it is the opinion of the National Advisory Committee for Aeronautics that the Air Mail Service is in effect an experimental laboratory for the development of the civil uses of aircraft, and that, viewed from this angle alone, it is worth what is costs over and above the value of the service it actually renders in the more rapid transportation of mail;

Resolved further, That the National Advisory Committee for Aeronautics submit a special report to the Congress through the President, stating that in its opinion the increasing relative importance of aircraft in warfare and the need for adopting and carrying through a sane, sound policy for the development of civil aviation, such as is outlined in the statement of a national aviation policy contained in the sixth annual report of the National Advisory Committee for Aeronautics, not only justifies but makes imperative the expenditure of public funds to aid the development of commercial aeronautics; and that, as an existing agency which has, in the face of many obstacles, accomplished remarkable results of real and permanent value to the Nation, and at relatively slight cost, the Air Mail Service of the Post Office Department should be continued.

New Airplane Tire Produced

Goodyear has developed new tires to take the shock of landing huge planes of approximately six tons' weight. Several of the new 44 x 10 cord airplane tires have been made and approved by the Glenn L. Martin Co. for use on the big Martin Bombers that will be placed in the service of the government. Goodyear has received an order for 76 of these new type tires.

Development of these airplane tires called for more real skill and brought up more complex problems than the development of the giant pneumatic cord truck tires.

Where pneumatic tires are built for traction and to sustain constantly heavy loads, the cord airplane tire required resiliency as its predominant characteristic, and yet needed the strength to sustain the shock of one of the 12,000-pound planes landing at a speed of approximately 40 miles an hour. The problem of development was difficult, as can be realized from the fact that each of the airplane tires is required to sustain at each landing more weight per tire than is supported by pneumatic truck tires of equal size.

The engineering problem was almost that of the truck tires reversed. Despite the fact that the airplane tire has fewer plies than the truck tire, has practically no traction tread except for a thin strip of rubber to prevent actual wear of the fabric, weighs but 47 pounds without tube or rim, and is inflated to but 75 pounds, it has proved its ability to sustain the tremendous shock of the Martin Bombers upon landing.

Jacuzzi Bros. to Operate Airway

Jacuzzi Bros., airplane manufacturers of Berkeley, Cal., are planning next spring to establish an air passenger service between Richmond, Oakland, San Francisco and Sacramento, it is announced through the Chamber of Commerce of San Francisco of which the brothers are members. It is proposed to put a six-passenger plane in this service and to maintain a regular schedule.

Airplane Radio Direction Finding

In view of the coming extensive use of radio direction finding in the Air Service in connection with cross-country flying, results of experiments conducted by Engineering Division, McCook Field as to the accuracy that may be expected will be of interest.

The experiments were conducted during the past summer using radio as a means of assisting airplanes to return to the home airdrome. The results of these experiments have shown that it is possible to guide an airplane with absolute accuracy to any radio transmitting station, and further that an experienced operator is not needed for this work.

The method used was that of two closed loops mounted on the wings of an airplane at right angles to each other, and operating upon a maximum signal. The particular installation used was mounted on a Curtiss JN-4-H airplane, and consisted of two main or "fore and aft" loops of four turns each, connected in series, one loop being mounted on the outside struts of each wing. The auxiliary loop consisted of four turns of wire and was mounted at right angles to the main loops, struts numbers 4 and 10 being used. The fuselage of the airplane was enclosed by this loop. The wire was sewed into fabric and the strips of fabric were doped on to the struts and wings of the airplane. Leads were brought from the loops into the rear cockpit of the airplane and there connections were made to suitable switches, condensers, amplifiers, etc.

When flying at a height of 2000 ft. it was possible to guide the airplane exactly over the transmitting station. This was done while allowing the man operating the switches in the rear cockpit to control the rudder, and thus steer the airplane as he desired. This experiment was tried both with experienced radio men in the rear cockpit and with men who knew absolutely nothing of radio and who did not know the Morse code. Results were the same in all cases—the airplane was brought directly to the transmitting station, no note being taken of the course steered from other than a radio standpoint. When flying at 2000 ft. it is possible for the operator to easily detect when the airplane passed as small a distance as 100 ft. from directly over the transmitting station.

These experiments do not embody any new departure in radio direction finding in airplanes. The method used was a part of the method brought out in England during the war, and which was to be used for navigating the Handley-Page night bombers of our Air Service. These experiments are cited merely to show the degree of accuracy which may be obtained when using this method of radio direction finding for guiding aircraft.

Aircraft Union Station

Arrangements have been completed whereby the air passenger service of San Diego and Los Angeles aviation companies will exchange landing rights. Business men and pleasure seekers can now make the trip in approximately an hour and three-quarters.

Edward Stevens, president of the Air Passenger service, and Pilot D. R. Matthews made the flight to Los Angeles last week to procure spare parts for the passenger planes. They were absent from the local field on Dutch Flats just five hours and twenty minutes, including the time spent in making their purchases in Los Angeles.

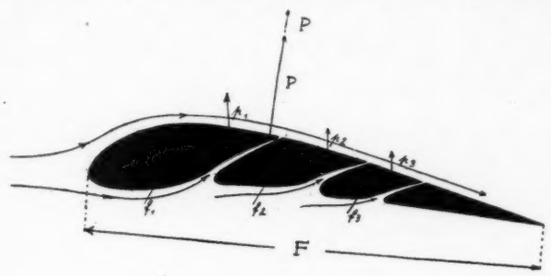
Mr. Stevens says that the outlook in the airplane passenger business is exceedingly good, and that his force is now engaged in assembling a second Curtiss Standard ship.

"I have been surprised," Mr. Stevens said, "at the enormous number of persons who are taking advantage of our offer to take passengers for sightseeing trips over the city for $5 each, which is just half the rate charged at many of the flying fields. While that fare does not leave us any margin of profit to speak of, we are accomplishing our main purpose of showing the public that the airplane is a safe and sane vehicle.

"The majority of our passengers now are those who go up for the novelty of aviation or because they love the sensation of flying, but we are gradually convincing the public that the airplane is no more dangerous than the automobile, and that it has a big feature as a commercial carrier."

A German Rival of the Handley-Page Wing

From *Flugsport* it would appear that a German inventor G. Lachmann applied for a patent in 1918 for a wing somewhat similar in conception to the Handley Page wing, which was refused by the German patent office, on the ground that



A German Wing Section

the arrangement was not likely to increase the effective lift of the wing.

The diagrammatic sketch represents the aerodynamic principles underlying the invention. With the peculiarly shaped passages the pressure on the under side and the suction on the upper are both taken as increased. No test results are available.

New Metallurgical Laboratory Apparatus

Catalogs have recently been received from the Eimer and Amend Co. illustrating a line of new metallurgical laboratory apparatus. One of these is the multiple replaceable unit electric furnaces for experimental heat treatments etc. These furnaces are constructed of patented units containing the heating coils held in by undercut grooves in the heat resisting material. One form is called the decalescent outfit for tool treating to determine proper hardening temperatures, etc.

Another piece of apparatus is the Kimley electro-analysis apparatus for the rapid determination of copper, tin, lead, zinc, etc. The stand is arranged to perform six analyses at the same time. The platinum electrodes are easily replaceable. With this apparatus, one man can handle fifteen or more samples a day, provided it is not necessary to separate antimony, if present, from the tin.

Kansas to Have Air Law

State regulation of aviation is provided for, with the creation of an aviation department of the state government, in a bill which is to be introduced in the Kansas senate at the present session by Senator R. C. Howard, of Arkansas City, editor of the Arkansas City *Traveller*, for the past thirty years. Senator Howard is serving his first term in the senate, but has been in the representatives' end of the state house before.

Senator Howard's bill will provide for aviation fields at various points in the state, under state regulation; the licensing of pilots in the state under rules to be set forth by the aviation department, and inspection of all planes by state inspectors.

British Military Essay to Be on Air Subject

Immensely significant evidence of the trend of thought as to the importance of aeronautics in matters of national defense is the announcement by the Royal United Service Institution of England that the subject of the Military Essay for 1921 is to be "The Influence of the Future of Aircraft Upon Problems of Imperial Defense." The essays are limited in length to approximately 16,500 words and should be submitted to the Royal United Service Institution on or before November 15, 1921. A gold medal will be awarded for the most meritorious.

foot clearance, so that a machine as large as an F-5-L, can be taken out on a roller truck and launched right at the factory doors, making a "fly away" delivery. One could scarcely ask for a better shop for final assembly of the largest aircraft. Six of these F-5-L flying boats have already been converted for commercial flying purposes. One is ready for delivery, one is under construction and two are contemplated. One plane of this type is equivalent to five planes of the DH type.

Propeller Department

A special propeller department is included in the plant and all propellers are designed and built at the factory. No cutting machines are employed; all propellers are custom-built to suit exact requirements. The usual full equipment is carried.

Machine Shop and Motor Department

The machine shop equipment is necessarily large to facilitate the manufacture of the four types of motors produced by this company as is shown by the photographs illustrating it. The maintenance of such a shop is of great advantage to the aircraft division and such a large and varied machine shop equipment is neither justified nor found in the average aircraft factory.

Among the equipment are a number of grinding machines of various types including, a disc grinder with a grinding surface approximately five feet in diameter, manufactured by the Chas. H. Besly Co., Chicago, Ill.; a cylinder sleeve grinder built by the Bryant Chucking Grinder Co., Springfield, Vt.; and a crankshaft grinder furnished by the Landis Tool Co., Waynesboro, Pa.; also several other smaller types of machines for various uses.

The lathe equipment is particularly complete, there being a crankshaft lathe of the heavy duty type built by the R. K. Le Blond Machine Tool Co., Cincinnati, Ohio, and other engine lathes built by the American Tool Works, Cincinnati, Ohio. Milling machines of various sizes are furnished by the Cincinnati Milling Machine Co., Cincinnati, Ohio, Van Norman Machine Co., Springfield, Mass. and the Briggs type millers built by Gooley & Edlund, Inc., Cortland, N. Y.

Bolts and small parts are made on Gridley automatics built by the National-Acme Co., Cleveland, Ohio, and for larger bar and chucking work automatics made by, Jones and Lamson Machine Co., Springfield, Vt. and Acme Machine Tool Co., Cincinnati, Ohio.

The drill press equipment varies from large radial drill Tool Co., Cincinnati. Ohio. The necessary small shapers and other machine shop equipment are consistent with the main machines mentioned above.

A completely equipped tool crib with metal racks manufactured by the Lyon Metallic Mfg. Co., Aurora, Ill., which is also used for a finished and rough parts store room, contains a complete assortment of cutters, special tools, jigs, and fixtures, needed for minimum cost quantity production.

Punch presses varying from a 100,000-pound machine to various chopping machines are used to avoid hand work on sheet metal parts production.

Motor Testing Laboratory

The motor testing laboratory is exceptionally complete, the building being separated from the main plant and containing a dynamometer laboratory and two small assembly rooms.

The equipment is a Sprague electric dynamometer of 250 horsepower capacity. This equipment is used for tests of short duration when accurate horsepower readings, fuel consumption and other tests are desired. The outside testing platform at the rear of the test laboratory building consists of torque stands equipped to perform standard Army and Navy tests and other trials of long duration.

A mercury weighing scale of an original type is used for measuring the pull on the torque arm. The usual accurate instruments needed in such tests are available.

Courtesy Extended on Visit

Thanks are due to the general manager, the chief engineer, and staff for facilities offered on a visit to the factory of which the Aeromarine Plane and Motor Co. may be justly proud of and justifies the Aeromarine claim that they are attacking the commercial aviation problem by practical performance rather than by theoretical speculation.

U. S. Imports and Exports of Aircraft

Years Ending June 30, 1912—1920

Previous to 1912, when the classification "aeroplanes" first appears, aircraft were incuded in the class "all other cars, carriages, and vehicles" so far as exports are concerned. If there were any importations of these commodities they would be included in the cassification of the paragraph of the tariff law under which the import duty was assessed, according to the chief value of component material, such as iron and steel or other metal, or manufactures of wood, flax or silk.

Pioneers will recall one or two importations of balloons in 1906-7. For the international balloon races, the aerostats were brought in under bond, which was cancelled on exportation after the race. Spherical, kite and dirigible balloons would be dutiable in imports according to the component material of chief value. In the statistics they would be included in the class of component material. In exports, they would be included in the class "All other articles."

Supplies for the American Expeditionary Force abroad which were shipped overseas on Army or Navy transports were not taken account of in the official statistics of exports from the United States for the reason that these vessels are not required to enter and clear, and collectors of customs have, therefore, no record of the cargoes of such vessels.

Military supplies and material sold to the allied governments, food-stuffs, clothing and other relief supplies shipped abroad by the Food Administration and the Red Cross were mostly carried on commercial vessels and are included in the official reports of exports. Vessels operated by the United States Shipping Board, either directly or under charter, enter and clear at the custom houses, and their cargoes are included in the statistics.

	EXPORTS			IMPORTS		
	Airplanes		Parts of (Engines alone, spares, etc.)	Airplanes		Parts of (Engines alone, spares, etc.)
	No.	Value	Value	No.	Value	Value
1912	29	$ 105,805	.....	17	$ 59,713	.....
1913	29	81,750	$ 25,802	13	50,920	$ 1,776
1914	74	188,924	37,225	1	1,856	30,405
1915	152	958,019	583,427	1	2,000	2,371
1916	269	2,158,295	4,843,610	..	.....	10,531
1917	135	1,001,542	3,133,903	4	40,818	20,650
1918	20	206,120	8,877,977	..	.....	518,176
1919	51	644,690	12,216,871	4	121,218	317,339
1920	63	459,294	643,270	57	108,904	351,394
	782	5,804,549	30,362,015	97	385,429	1,306,642
		Total exports		$ 36,166,564		
		Total imports		1,692,071		

Following is a statement of aircraft shipped abroad in 1918 to the American Expeditionary Force and to the Allies. These figures probably include the items in above tabulation of which the Department of Commerce has record. It is not possible to distinguish between those recorded as exports by the Department of Commerce and those unrecorded, as to amounts, for 1918.

Aircraft and Approximate Cost Floated out of the United States during the Calendar Year 1918

Classification	Number	Value
Airplanes	2400	$ 32,321,197
engines spares, spare parts, spare instruments		
engine spares, spare parts, spare instruments and armament, spare propellers, etc.)		60,107,501
Balloons	441	3,528,000
Balloon Essentials (including cable, hydrogen cylinders, caustic soda, ferro silicon, etc.)		1,235,039
Approximate cost of aircraft floated out of the United States during calendar year 1918		$ 97,191,737

Air Service records indicate that no aircraft were floated during 1919.

Monthly and quarterly summaries of imports and exports are published by the Department of Commerce, Washington, D. C.

Italian Aviation

By Lieut.-Col. Cristoforo Ferrari

Chief of Technical Division, Italian Air Service

On August 25, 1920, by initiative of His Excellency the Minister of War and of the high Commander of Aviation, the representatives of associations and firms constructing airplanes as well as representatives of the press were called in conference at Rome for an exchange of views concerning the principle questions in regard to civil aeronautics. This meeting, appropriately supplementing those which had taken place at the end of July and on the beginning of August under the auspices of the Aeronautical Consulting Commission was the cause of animated discussions. As far as the desired establishment of civil aeronautics is concerned, this meeting can be considered as one of the first public manifestations of interest on the part of the Ministry of War.

Present Italian Aeronautic Organization

On July 1, 1920, the General Department of Civil Aeronautics which was a part of the Ministry of Industries was discontinued. Its activities were assumed by the Ministry for War and came under the Aviation High Command. This Aviation High Command is divided into three branches: Military Service, Technical Services for aviation of any kind, and Civil Aviation. There are, of course, also administrative bureaus. The Aviation bureau of the Ministry of the Navy has its own aeronautical service.

In the same way in which the Army plans for troop mobilization, the government will plan for the mobilization of industries, in order to be ready to start them at the right moment, in well ordered production.

It is not advisable for military aviation to accumulate vast supplies of aircraft as types soon become obsolete and depreciate in value. Until the aeronautic industry is able to get into production it will be necessary that all classes of civil planes suitable be reconstructed in such a way as to receive armaments, bombing and torpedoing installations.

Proposal of a National Congress

It seems worth while, to consider how the new-born civil aviation may come out of the present embarrassing situation and, consider its future, growth and development. In my opinion the best way to accomplsh this, is the calling of a large national meeting or congress, open to all concerned, manufacturers, organizations, experts and students of aviation, no matter what their position may be, a conference in which the state should be officially represented. Such a congress should last as long as necessary to permit exhaustive studies and calm discussions. It might be divided into sections so that the work could be appropriately distributed, but all sections should finally come together to and state their conclusions. It should then be the task of the official representatives of the government to consider those points in which the cooperation of the state is involved.

...rought directly to the transmitting station, no note being taken of the course steered from other than a radio standpoint. When flying at 2000 ft. it is possible for the operator ...o easily detect when the airplane passed as small a distance as 100 ft. from directly over the transmitting station.

T...ese experiments do not embody any new departure in radio direction finding in airplanes. The method used was a part of the method brought out in England during the war, and which was to be used for navigating the Handley-Page night bombers of our Air Service. These experiments are cited merely to show the degree of accuracy which may be obtained when using this method of radio direction finding for guiding aircraft.

...trie furnaces for experimental heat treatments etc. These furnaces are constructed of patented units containing the heating coils held in by undercut grooves in the heat resisting material. One form is called the decalescent outfit for tool treating to determine proper hardening temperatures, etc.

Another piece of apparatus is the Kimley electro-analysis apparatus for the rapid determination of copper, tin, lead, zinc, etc. The stand is arranged to perform six analyses at the same time. The platinum electrodes are easily replaceable. With this apparatus, one man can handle fifteen or more samples a day, provided it is not necessary to separate antimony, if present, from the tin.

Aircraft Union Station

Arrangements have been completed whereby the air passenger service of San Diego and Los Angeles aviation companies will exchange landing rights. Business men and pleasure seekers can now make the trip in approximately an hour and three-quarters.

Edward Stevens, president of the Air Passenger service, and Pilot D. R. Matthews made the flight to Los Angeles last week to procure spare parts for the passenger planes. They were absent from the local field on Dutch Flats just five hours and twenty minutes, including the time spent in making their purchases in Los Angeles.

Mr. Stevens says that the outlook in the airplane passenger business is exceedingly good, and that his force is now engaged in assembling a second Curtiss Standard ship.

"I have been surprised," Mr. Stevens said, "at the enormous number of persons who are taking advantage of our offer to take passengers for sightseeing trips over the city for $5 each, which is just half the rate charged at many of the flying fields. While that fare does not leave us any margin of profit to speak of, we are accomplishing our main purpose of showing the public that the airplane is a safe and sane vehicle.

"The majority of our passengers now are those who go up for the novelty of aviation or because they love the sensation of flying, but we are gradually convincing the public that the airplane is no more dangerous than the automobile, and that it has a big feature as a commercial carrier."

Kansas to Have Air Law

State regulation of aviation is provided for, with the creation of an aviation department of the state government, in a bill which is to be introduced in the Kansas senate at the present session by Senator R. C. Howard, of Arkansas City, editor of the Arkansas City *Traveller*, for the past thirty years. Senator Howard is serving his first term in the senate, but has been in the representatives' end of the state house before.

Senator Howard's bill will provide for aviation fields at various points in the state, under state regulation; the licensing of pilots in the state under rules to be set forth by the aviation department, and inspection of all planes by state inspectors.

British Military Essay to Be on Air Subject

Immensely significant evidence of the trend of thought as to the importance of aeronautics in matters of national defense is the announcement by the Royal United Service Institution of England that the subject of the Military Essay for 1921 is to be "The Influence of the Future of Aircraft Upon Problems of Imperial Defense." The essays are limited in length to approximately 16,500 words and should be submitted to the Royal United Service Institution on or before November 15, 1921. A gold medal will be awarded for the most meritorious.

Western Airline Syndicate

The announcement comes from the Cincinnati Aircraft Co. that C. E. Lay formerly president of the company, while still retaining his connection with that concern, is organizing a larger corporation which he is to head, that of the Western Airline Syndicate.

During the past season Mr. Lay has operated eight planes in passenger and exhibition work. The planes which are said to have done almost continuous service, have traveled thousands of miles entirely without accident. Mr. Lay attributes his remarkable success in operating his planes largely to the fact that he has intelligently made use of the Weather Bureau reports of flying conditions. His pilots have been kept constantly posted on weather conditions and were under orders to move their planes in time to locate them in a territory where flying weather prevailed.

In an interview a few days ago Mr. Lay stated that he considered the revenue from exhibition flight and passenger carrying "Barnstorming" virtually at an end. "What the people want now is regularly scheduled airline service. I do not consider that it is a time yet for a full fledged passenger service by air," he said. "We must begin with a freight service and gradually develop the passenger carrying plane as the present equipment will not give us enough revenue but we can make good as an express line until such time as the engineer develops something for us, and until that time the passenger will have to be carried at his pound rate.

"I shall endeavor to establish our lines over the less hazardous flying territory, reaching the greatest centers of population offering the shortest flights. These express lines will have an advantage in operation over our present conditions, in that there will be less wear and tear on equipment as we will avoid the continuous landings and take-offs enabling us to throttle down our engines while in the air and save them a great deal. We will cut our overhead all around."

The first step in the detailed work of getting the Western Airline organization started was begun in the several cities on November 29, when M. H. Held, business manager, started soliciting business men to ascertain and compile tonnage that will be available for air transportation and comparing the relative costs. Chief engineer Witherup, together with Lee Shephard, vice-president, are making an extensive trip through the middle west viewing numerous sites for a factory and test fields which have been submitted by industrial agents of the several railroads.

Nothing definite has been accomplished along this line but it is said that an ideal location has been submitted near Chicago. A new two cycle engine has been developed and tried out. This engine develops 130 horsepower replacing in the same equipment the present 90 horsepower power plant. Several changes will also be made in the fuselage to admit the carrying of a greater load.

Diggin's Flying School

The Ralph C. Diggins School of Flight and Commercial Aviation Co. has increased its capitalization to $30,000 in order to carry on commercial aviation on an enlarged scale. Important changes are being made at the Diggin's Airdrome in Chicago including the installation of a wireless station for both telegraph and telephone, and the erection of a building on the field to be used as living quarters for the students. These quarters will contain a large airy dormitory equipped with comfortable beds, a dining room, shower baths, a library and conveniences to make the life of the student comfortable.

Several new courses have been added to the curriculum. The ground course consists of engine instruction, assembly, dissembly, carburetion, ignition, trouble shooting, overhauling, etc. The plane work consists of assembly and dissembly, repairing; covering; wood, metal and wire working; materials, etc. A course in aerial navigation, instruments, field management and general instruction is also included.

Lectures and class-room work will be carried on during the middle of the day while the flying instruction will be given in the early morning and late in the afternoon. Curtiss and Avro planes are used for instruction while work is given on three types of engines, the vertical, the V-type and the rotary. During the past season this school graduated thirty-one pilots.

Aviation Activities in Portland, Ore.

With three aviation schools well established, a factory for assembling airplanes now in operation and two companies operating flying machines commercially, Portland has already assumed its place as one of the aviation centers of the northwest.

The first important move for the development of aviation there was over a year ago, when a number of prominent business men of the city organized the Oregon, Washington and Idaho Airplane Co. The Lewis & Clark field was laid out and the first flight made by a machine of the company occurred on November 4, 1919.

From that beginning, aviation rapidly developed as a feature of the life of the city. Other concerns were organized or came to the city. The city flying field, now known as Broomfield Flying Field, was laid out and fields were established at various other points in the state.

The Dudrey Aircraft company was the first to see the possibilities in an educational institution for the teaching of fliers. The result was that the Dudrey school of aeronautics was organized and a building erected on Broomfield Field, containing shops and lecture rooms and equipment for teaching flying.

From this the work of teaching aviation in the city has rapidly developed. In addition to the Dudrey school, the Oregon, Washington and Idaho Airplane Co. is now conducting a school, and the Adcox auto and gas engine school has instituted a department for teaching the mechanics of airplane engines. The schools already have an aggregate enrollment of over 100 pupils and there is developing throughout the northwest a growing interest in this line of work.

The course in aviation given students is quite complete. The Adcox school specializes in engines and their construction and repair, the Oregon, Washington and Idaho company's school and the Dudrey school take up both the construction of planes and engines and actual flying. The Adcox school also has an arrangement with the Oregon, Washington and Idaho company for teaching its students flying, if they desire that work.

The start for making Portland an airplane manufacturing center came during the month of November, when the assembly plant of the Angeles Aircraft Corp. was established at East Ninth and Marion streets in Sellwood. This company turns out a small one-man machine known as a "flivver" in the flying world, a machine which is declared to be within the reach of everyone's purse. The machines are of both the monoplane and biplane types.

Airplane Patrols in Morocco

Although the life of a tourist is considered unsafe if he proceeds farther into Morocco than to the points at which the French blockhouse system assures protection, according to the New York *Herald* travellers returned recently from there tell of airplane surveillance which has been instituted by General Lyautey, and which is having a strong civilizing effect.

It would require a standing army of 500,000 men to supervise properly every dangerous quarter in a country where religious as well as national ambitions are constantly conflicting, yet ten air squadrons are so efficiently covering the whole territory that in the last few years the number of attacks in the interior are understood to have decreased 90 per cent.

The work is not without its dangerous feature, however, for since the war, hundreds of natives who had served in the French army managed to secrete rifles and ammunition in the hills, with the result that the airplanes frequently return with their wings riddled with bullets. But these encounters rarely reach the attention of the public, and the French forces, despite casualties, are continuing their efforts to pacify the country, which has never been subjected by aliens.

Commuter F. G. Ericson's Home

On the cover of this issue is the Canadian home of F. G. Ericson the well-known areonautical constructor at Valhalla, Ont., 32 miles west of Toronto. Mr. Ericson's flying field adjoins his home and from here he commutes to Toronto whenever he wishes to go to that city. Often he takes Mrs. Ericson and their baby who he claims is the youngest flying passenger in aeronautics.

ONLY a performance so obviously above the usual as to be really outstanding can reconcile the distinct preference aviation experts show for Wright Aeronautical Engines.

A greater speed with lower cubic inch capacity—flexibility that allows for quickest manoeuvring—a safer landing speed—a greater length of "life" in flying hours—prove that no one factor in its design is responsible for its rugged, trustworthy performance—but rather a combination of carefully designed units that bear their relative responsibilities.

WRIGHT AERONAUTICAL CORPORATION
PATERSON, N. J.

Wright Aeronautical Engine Model E-2, 180 H. P.

Member Manufacturers' Aircraft Association

WRIGHT
AERONAUTICAL ENGINES
STANDARD MOTIVE POWER FOR ALL AIRCRAFT

ANSALDO AEROPLANES

ANSALDO SVA Model 9 Two Seater. Dual Controls. Powered with SPA 220 H.P. Motor: Steel Landing Gear and Struts.

ANNOUNCING 25% REDUCTION
FOR LIMITED PERIOD ONLY

$5,000

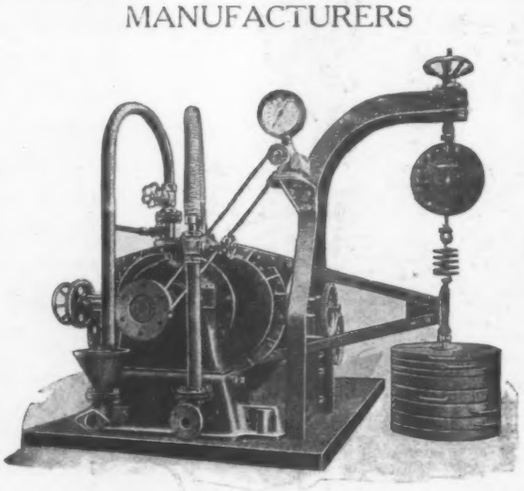
F.O.B. New York
Immediate Delivery

AERO IMPORT CORPORATION
1819 BROADWAY, NEW YORK
WRITE FOR OUR BOOKLET, DESCRIBING 2, 3 & 6 PLACE ANSALDO SVA PLANES.

FROUDE HYDRAULIC ABSORPTION DYNAMOMETERS

HAVE PROVED SUCCESSFUL IN THE TEST ROOMS OF MANY MOTOR MANUFACTURERS

Froude Dynamometers are built in all sizes and in special types for testing or running-in gas engines. Each dynamometer has a large capacity and speed range.



Froude Dynamometers are scientifically accurate, inexpensive and easily operated. They operate silently and either load or speed or both may be varied while operating.

WRITE FOR BULLETIN F-70

C. H. WHEELER MFG. CO.
PHILADELPHIA, PA.

The Spark Plug That Cleans Itself

B. G.

Contractors to the U. S. Army Air Service

THE BREWSTER-GOLDSMITH CORP.

33 GOLD STREET

NEW YORK CITY U. S. A.

Warwick **NON-TEAR** *Aero-Cloth*

A SAFE CLOTH *for* FLYING

For Particulars Apply to

WELLINGTON SEARS & CO.

66 Worth Street, New York

ROEBLING

Aircraft Wire, Strand and Cord

Thimbles and Ferrules

JOHN A. ROEBLING'S SONS CO.

TRENTON, N. J.

HARTSHORN STREAMLINE WIRES

Assembled with Hartshorn Universal Strap Ends make the Ideal Aeroplane Tie Rods—diminished wind resistance insuring greater speed.

This fact was proved in the recent speed test for the Pulitzer Trophy. Four of the first five ships were equipped with Hartshorn Streamline Tie Rods.

Write for circular A-1 describing our Wires and Strap End Fittings.

STEWART HARTSHORN CO.

250 FIFTH AVENUE, NEW YORK

IF YOU WANT TO FLY

We'll Make You a Pilot.

Our methods instil confidence from the start. You know you are flying with the most skilled instructors and the best equipment—from the safest field—that money can buy. Our average student qualifies for the International Pilots License after seven hours in the air. The cost is based on the time it takes to qualify with safety.

Philadelphia Aero-Service Corp.,
636 Real Estate Trust Bldg.,
PHILADELPHIA, PA.

Exceptional Opportunity

THREE PLANES

Brand New Canuck - New 100 HP. OXX-6 Motor Will Carry Three	$2,800.00
Brand New Canuck - Rebuilt OX-5 Motor Never Run Since	2,650.00
Slightly Used Canuck - Motor A. 1. Flown 25 Hours Without Mishap	2,400.00

These planes for delivery at once or insured and stored free until spring on deposit of 50 per cent. Planes of this class will bring much higher prices in spring.

NEW CANUCK PARTS (ALSO OX-5) 33 PER CENT TO 50 PER CENT BELOW LIST WHILE THEY LAST. RADIATORS (A. 1.) $25.00. FEW "D" PARTS AT A SACRIFICE.

!GET OUR CUT PRICE LIST!

DE LUXE AIR SERVICE, Inc.

ASBURY PARK, NEW JERSEY

Flottorp Manufacturing Co.

AIRCRAFT PROPELLERS

Established 1912

213 Lyon St., Grand Rapids, Michigan

Contractors to United States Government

Al - SOLDER

FOR AIRCRAFT WORK

Tests of ***Al-SOLDER*** at numerous large plants have demonstrated its superiority in tensile strength and resistance to fatigue.

Al-SOLDER is an engineering product which will solve for airplane and airship constructors many of the welding and rivetting difficulties which have prevented more extensive use of light alloys.

Especially valuable in restoring to long service cracked or broken engine castings.

Send for Engineering Details

ROHDE LABORATORY SUPPLY CO.
17 Madison Ave. New York

WHAT THE PILOTS SAY ABOUT THE PIONEER BANKING INDICATOR

A CAPTAIN IN THE AIR SERVICE:
The instrument is splendid. I thought at first that it would be too sensitive. It works perfectly and is particularly useful in long cross-country flights, when one is apt to get a little tired and perhaps careless. With the Banking Indicator in front of you, you always keep the ship level on a straightaway, and it must prevent unknown detours and carry you on your course much more directly than without it.

ROLAND ROHLFS, CURTISS TEST PILOT:
The instrument is entirely reliable and well acting in every respect. It responds readily to any incorrect banking maneuver. In other words, whenever the machine is banked too much or not enough the white disc appears on the side of the instrument that represents the wing that should be raised to correct the error. . . . . I would say that it performs all the duties of any Banking Indicator perfectly, and the novelty of having the white disc show when incorrect banks are made is very good.

TEST PILOT, POST OFFICE AIR SERVICE:
Your small Banking Indicator is by far the best yet. The Indicator is so sensitive that indications are given long before the human senses can notice the divergence from the lateral horizontal. It also seems to have the property of being very stable in action in spite of the great sensitiveness.

PIONEER INSTRUMENT COMPANY
136 Havemeyer Street Brooklyn N Y

AN EXPLORER IN THE AIR SERVICE

BY HIRAM BINGHAM

Formerly Lieutenant Colonel in the Air Service

This book, with its many illustrations, its anecdotes of aviation life and its clear and readable account of the United States Air Service is in itself a great contribution to the future of aviation in this country. It should be in the possession of every aviator. $10.00.

YALE UNIVERSITY PRESS
New Haven New York

LEARN TO FLY
IN CHICAGO

Write at once for interesting description of flying school and our splendid enrollment offer.

America's Foremost Flying School
Third Successful Season
Students Now Enrolling For Spring Classes
Best Airdrome in the U.S.
Aero Club of IllinoisField
Thorough Ground Mechanics & Flying Training
Dozens of satisfied Graduates our best recommendation.

THE RALPH C. DIGGINS CO.
140 N. Dearborn St., Dept. C CHICAGO

FREDERICK W. BARKER

REGISTERED PATENT ATTORNEY

2 RECTOR STREET NEW YORK

Telephone 4174 Rector *Over 30 Years in Practice*

PRESIDENT
AERONAUTICAL SOCIETY OF AMERICA
FROM 1915 TO 1919

SPECIALTY: Patent Claims That Protect

AMPHIBIOUS GEARS

Write for full particulars

ALEXANDER KLEMIN AND ASSOCIATES
Consulting Aeronautical Engineers
22 East 17th Street New York, N. Y.